SCIENCE.

FRIDAY, NOVEMBER 16, 1883.

FROM SUPERSTITION TO HUMBUG.

It is related that especially fortunate English commanders in India have encountered a tendency among the ignorant natives to exalt them as more than human beings. It is not strange that a benighted and superstitious populace, astonished by exhibitions of power to it incomprehensible, should, for a time, turn from its own hazy gods to new and visible wonder-workers.

A somewhat similar revolution appears to accompany the progress of physical science. What its friends have to contend with at present is not so much indifference or hostility, though these are not altogether lacking, as a too implicit and childlike confidence in the efficiency of scientific knowledge on the part of those to whom its ways are in the main unknown.

The real conquests of science have been so vast and unexpected, so much like the workings of magic, that people eagerly pay their homage to a power, which, though mysterious enough to engage their credulity, accomplishes every day feats that witches, ghosts, and magicians performed only upon rare occasions. A genuine scientific man will disdain to abuse this confidence; but there are always camp-followers of the scientific army, who will find in it their opportunity. It is curious to see how those, who, a generation or two ago, would have been the believers in witchcraft and all things 'supernatural,' are now turning to be caught in the toils of scientific charlatanry. The wizard of the present day is an electrician. Electricity and magnetism have become literally words to conjure with.

There is a certain progress in this, though not in itself a valuable progress. It is the advance from sheer ignorance to that little knowledge which is proverbially a dangerous thing. It is the advance from pure superstition, in which men did not reason at all, to humbug, in which they reason from false or insufficient premises to wrong conclusions.

It should be said in justice to the scientific charlatan, that he is frequently not dangerous, and is nearly always amusing. He possesses an audacity, a volubility, that, combined with his habit of blundering, make him a far more cheerful person to contemplate than his gloomy predecessor, the sorcerer. Take, for instance, the modern master of that ancient black art of divination by rods. A newspaper report makes a 'professor' of the science of 'magnetic geology,' as he calls it, speak as follows: —

> "You take the ends of the forks, and grasp them tightly in either hand, allowing that portion where the forks join to point upward. . . . When one walks over a mineral substance in the ground, the electricity ascends through the body into the hands and rod, and draws the central or connecting portion of the rod downward. When this occurs, minerals exist beneath the spot where you stand. If the rod begins to move as the person walks along, take particular notice of the spot where you stand when the movement begins. When the rod turns completely over, measure the distance from where it first began to move to the spot where it indicates minerals. This distance will give you the depth at which the mineral can be found."

'Rabdomancy, or divination by rods, is as old as history,' some one recently remarked. The feature of this science peculiar to our age is the pretence of explaining it. That the method is still resorted to quite widely, there can be no doubt. We read in a Vermont paper, that a few months ago the public authorities of Middlebury resorted to the rod when about to sink an artesian well. They then sank a shaft eighty feet at the spot designated, and there struck, not water, but flint. We have lately heard of a man who ascertains by the divining-rod the proper spot for rounding lightning-rods. We have never seen a statement of his theory in his own words; but it

appears that he holds the doctrine that atmospheric electricity follows, or is controlled by, the course of underground electric currents. He claims, moreover, to be endowed with a peculiar sensitiveness that enables him, by walking over the ground with the forked stick in his hands, to detect the location of these currents. The last touch is given to this theory by the statement that it is necessary for the gifted manipulator of the rod to wear rubber boots during the operation of divining, in order that he may be insulated from the ground.

In regard to the human body and the remedies for its ills, people have always been superstitious; and so, naturally enough, the number of 'electric' and 'magnetic' nostrums offered to afflicted humanity is very great. Their descriptions, however, are nearly always worth reading. Custom cannot stale the infinite variety of their absurdities. Here is a specimen which came to hand a few days since in the advertising columns of a college paper: —

"Labor, study, and research in America, Europe, and Eastern lands, have resulted in the Magnetic Lung Protector, . . . which, . . . with the continuous stream of magnetism permeating through the afflicted organs, must restore them to a healthy action."

There is a class of people who call themselves magnetic physicians, — people who cure, in a modern way, by the laying-on of hands. They are apparently closely allied to the spiritualistic mediums, and evidently intend to use something more than a figure of speech in calling themselves magnetic. There is, for instance, in or near San Francisco, a certain Dr. H——, who gives people what he calls magnetic baths. He claims to magnetize the water for the baths by dipping his hand in it. He is said to have an extensive practice. We have heard that the notorious Slade, whose feats made such an impression upon Professor Zöllner, claimed to possess a literal magnetic power, enabling him to rotate the plane of polarisation of light.

Whatever may be the case with these peculiar people it appears that others, not especially superstitious, do believe themselves particularly endowed or charged with electricity, because, for instance, they succeed in drawing sparks from their hair or clothing during cold weather. Of course, some people do have drier hair, or drier skins, than others, and do, therefore, as frictional electrical machines, surpass the majority of their fellow-mortals. Moreover, physiologists believe that in living bodies there exist slight electric currents capable of being detected by very sensitive apparatus. But apparently it is not with any intelligent reference to these exceedingly minute currents, or to an electric charge acquired by friction, that a man speaks, when he offers to rub a weak or disabled arm because he is 'strong, and full of electricity, you know.' The fact is, we do not know, and we wish the man would explain.

It would appear that such terms as 'animal magnetism,' and 'personal magnetism,' originating, no doubt, in metaphor, are sometimes taken almost literally. We have met one or two very intelligent people who seemed to have a vague idea that psychological problems might be attacked by means of the laws of electricity and magnetism.

This list of frauds and delusions might be greatly extended. Enough has been said, however, to illustrate some of the kinds of error into which people are led by their ignorance of the results and methods of scientific research. The need of a wider and more intimate knowledge of physics in the education of all classes would, no doubt, be generally acknowledged. It should be observed, however, that the kind of half-knowledge of this subject which is frequently obtained from newspapers, and even from public lectures and popular scientific books, is the very pabulum of such errors and humbugs as we have described. A woman hears a lecture on sympathetic vibrations, fundamental tones, etc., notes the trembling of a church under the music of the organ, and writes to her religious paper an enthusiastic letter explaining the fall of Jericho in a scientific manner, — and all in the interests of revealed religion.

A man reads, or sees in a public hall, that two electrified pith-balls attract or repel each other. He learns that the human body may be charged with electricity. Straightway he begins, upon this basis, to explain the table-tipping feats of spiritualistic mediums, — a gross error, hardly more respectable than the pure superstitition of the veriest believer in ghosts.

To make such errors impossible would require that definite, familiar knowledge of things, in their quantitative relations, which is hardly to be obtained without actual contact. It would require a laboratory training; and it is perhaps impossible to make provision for a very extended training of this sort in any scheme of general education.

The tendency of the times, however, is toward the objective and experimental in teaching; and it is probable that the next few years will see considerable changes in the methods of general instruction in physics.

WHIRLWINDS, CYCLONES, AND TORNADOES.[1] — III.

WE may now pass on from the small daytime whirls of dry air to the larger, long-enduring storms that are accompanied by rain; and here will be met two new elements, — the effect of condensing vapor, and the effect of the earth's rotation, — both of great importance. As a sample under this second heading, we may take one of the cyclones of the Bay of Bengal; for the storms there are very characteristic of their class, and have of late years received much careful attention. There is good reason for thinking that these cyclones generally spring up in calms, much as the desert-whirls begin. The seasons and regions of their occurrence both point to that conclusion; for tropical cyclones seem never to begin in well-established wind-currents, but rather in a place of quiet, weak, or variable winds. By India, for example, the cyclones are almost unknown during the prevalence of the steady blowing monsoons, but are not uncommon at those seasons when the monsoons change; that is, at times when the air has no well-established motion, but stands about idly, waiting for a decisive command to move on. During these idle times of stagnation, the lower air may become very warm and moist, and so prepare for a stormy overturning. The calm that precedes a cyclone often makes part of the description of a storm at sea: the air is close and oppressively warm; the water settles down to a glassy surface; and now we may see, what is not always clearly expressed, that this calmness of the water, and oppressive heat of the air, are not antecedent effects of the coming storm, but are actually the conditions that allow and determine the beginning of a storm. The warmer the air and the quieter the water, the longer must have been the preparatory stage; the greater the quantity of solar force collected in the lower atmosphere, the more violent will be the storm when it begins. This warm calm is really the embryo of the cyclone; and, if it lie long enough in a proper latitude, it will grow to well-developed maturity.

It is often stated that tropical oceanic cyclones begin at the meeting of two opposite currents of air rather than at a time of calm. This may be true for some cases, and undoubtedly has a very general application in temperate latitudes; but it seems more probable that in the Bengal cyclones, and most other tropical hurricanes, this stage is a little later than the earliest beginning, and is really the first development of the inblowing winds. A general calm would doubtless be found to precede such opposed currents if observation could trace the antecedent conditions a little farther back than is usually possible. The principal contrasts between the desert-whirls and the Bengal cyclones, at the time of their beginning, may be thus summarized: —

First, The area and uniformity of the surface on which the disturbance is developed is much greater on the ocean than on the desert.

Second, There is a lower temperature, but a much greater amount of heat, surface for surface, in the cyclone's embryo, than in the whirlwind's. The temperature of the air over the ocean seldom exceeds 95°: over the desert sands it may often rise to 140° or 150° close to the ground. But on the desert the stratum of air that is so excessively warmed is very thin; it often fails to reach the height of a man's eye, and so gives the appearance of a mirage: while over the sea, although the lower stratum is not so warm, its thickness is greater, and there is more of it warmed. What it lacks in temperature it more than makes up in quantity.

Third, The presence of water-vapor over the ocean makes a most important contrast between the two cases; and it is on this account that the warm sea-air is cooler than the hot desert-

[1] Continued from No. 40.

air. Water-vapor is not nearly so diathermous as dry air. Much of the heat that would pass down to the sand on the desert is held back by the vapor over the ocean, and some is caught again from the heat radiated upwards by the water, so that a considerable thickness of air is warmed. Of still more importance is the vapor's action as a great storehouse of solar force, required in the process of its evaporation, generally known as 'latent heat.' For all these reasons, the accumulation of energy in the preparation for an oceanic cyclone is vastly greater than in the making ready for a desert-whirl.

(To be continued.)

REMARKS UPON THE OSTEOLOGY OF PHALACROCORAX BICRISTATUS.

It is a fortunate thing for science, that time allowed many of our Alaskan explorers to bring back in their collections, and to the museums, skeletons of so many of the rarer forms of the vertebrates, particularly the birds of those unfrequented regions. To Dr. T. H. Bean and Mr. H. W. Elliott, both of the Smithsonian institution, we are under lasting obligations for such material, and for making so good use of their advantages. The writer has enjoyed the unusual privilege of examining and studying long series of skeletons of Lobipes hyperboreus, Haematopus niger, rare forms of Rissa, Larus, and Sterna, many of the auks, puffins, and the like, — nearly all from the source that I have mentioned.

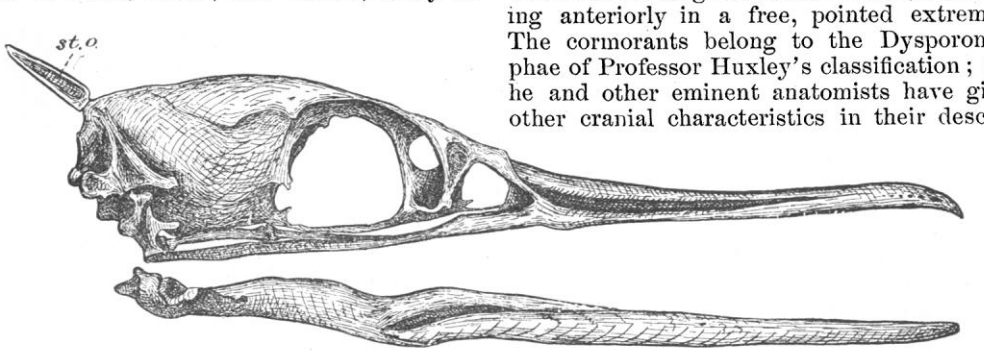


Fig. 1. — Skull of Phalacrocorax bicristatus, life size; right lateral view, showing occipital style, *st. o.*

It was during the course of my examination of these sub-arctic rarities that my attention was called to several points of interest in a set of skeletons, representing three young and an old one, of a species of cormorant, Phalacrocorax bicristatus, forming part of the collection of the last-named naturalist. Professor Owen, in the second volume of his 'Comparative anatomy and physiology of vertebrates,' on p. 64, speaks of a bony style that is attached to the occiput in the cormorant as one of the cranial peculiarities of the class. This author does not mention its use; and as the writer has not a cormorant before him intact, with all the soft parts, it would be hardly safe to give its exact function in this bird's economy: but as I do not believe we have a figure showing the site of this bonelet, an illustration of the skull of Phalacrocorax is here given, showing, life-size, the right lateral view. This prominent style is seen protruding from the summit of the occiput in my drawing, not as a spinous outgrowth from that point, but rather as a free bone, concave below, separated into two concavities on its superior aspect by a sharp median crest that is developed on its entire length, — a transverse elliptical facet anteriorly, that articulates freely with a corresponding one on the occiput.

At the base of the cranium, we find that the pterygoids are completely overshadowed by the sub-compressed but rather large brain-case above. There are no basi-sphenoidal processes thrown out to meet these bones. The posterior halves of the palatines form a close union all along their median and inner margins, which portions are much spread out horizontally. Beyond, they become narrower; and in the space that we find existing between them we observe a long attenuated vomer, terminating anteriorly in a free, pointed extremity. The cormorants belong to the Dysporomorphae of Professor Huxley's classification; and he and other eminent anatomists have given other cranial characteristics in their descriptions of this well-defined group. The rami of the lower mandible are deeply grooved on the inner aspects of the dentary portion; and these elements, originally free, retain their sutures, distinctly marked, through life, where they join the other interested segments at the posterior moiety. Seventeen vertebrae are found in the cervical region, before we arrive at one that bears a free pair of ribs. Of this

series, we find the atlas and axis articulating in the usual manner, the former with its cup-like depression with the occipital condyle, the vertebra being perforated at its base. The parial parapophyses beneath the centra of these vertebrae are more or less prominent throughout; but in the eighth, ninth, and tenth, they are developed to an unusual extent, being long, needle-like processes, reaching nearly the entire length of the vertebra. A small pair of rudimentary free ribs are found beneath the transverse processes of the eighteenth vertebra. The next two ensuing ones have their ribs well developed, and bear large uncinate processes; but their lower ends still fail to be connected with the sternum by the intervention of costal ribs. Three more dorsal vertebrae are found before we come to the anchylosed series of the sacrum. These all have true ribs connected with the sternum by costal ribs, and their uncinate processes are strongly produced. A pair of ribs, as well developed in every particular as the series just mentioned, springs from beneath the ilium on either side, joining costal ones below; but the last pair of all, or the second that is produced from the anchylosed vertebrae of the sacrum, is without the uncinate processes, and in the specimen before us the costal rib on the left side is the only one of this pair that meets the sternum in a true facet. On the opposite side it articulates along the posterior border of the haemapophysis beyond it. The neural spines completely coalesce, in the ultimate sacral vertebrae, into a well-pronounced crest, which is surmounted along its entire length with a spreading cap of bone.

There are six free caudal vertebrae, not including the terminal segment or pygostyle, here quite large, pointed above, and possessing a moderately dilated posterior margin, thrown out to support the rectrices of the tail. The two anterior free caudal vertebrae are quite firmly grasped on either side by characteristic spine-like processes thrown backward, and developed on the part of the ilia. A lateral view of the pelvis, which is very long and much compressed from side to side, shows the ischiadic foramen to be an unusually large aperture, while the slender pubic bone fails to close in the other two foramina below, that are found in many other birds. This last-mentioned element of the pelvis slightly expands behind, where it meets the lower margin of the ischium for about a centimetre of its length. It then contracts again in size a little, to be directed downwards, and curved inwards. The body of the sternum is quadrilateral in outline, with two rather shallow excavations on either side of the median line, occupying the entire xiphoidal margin or border.

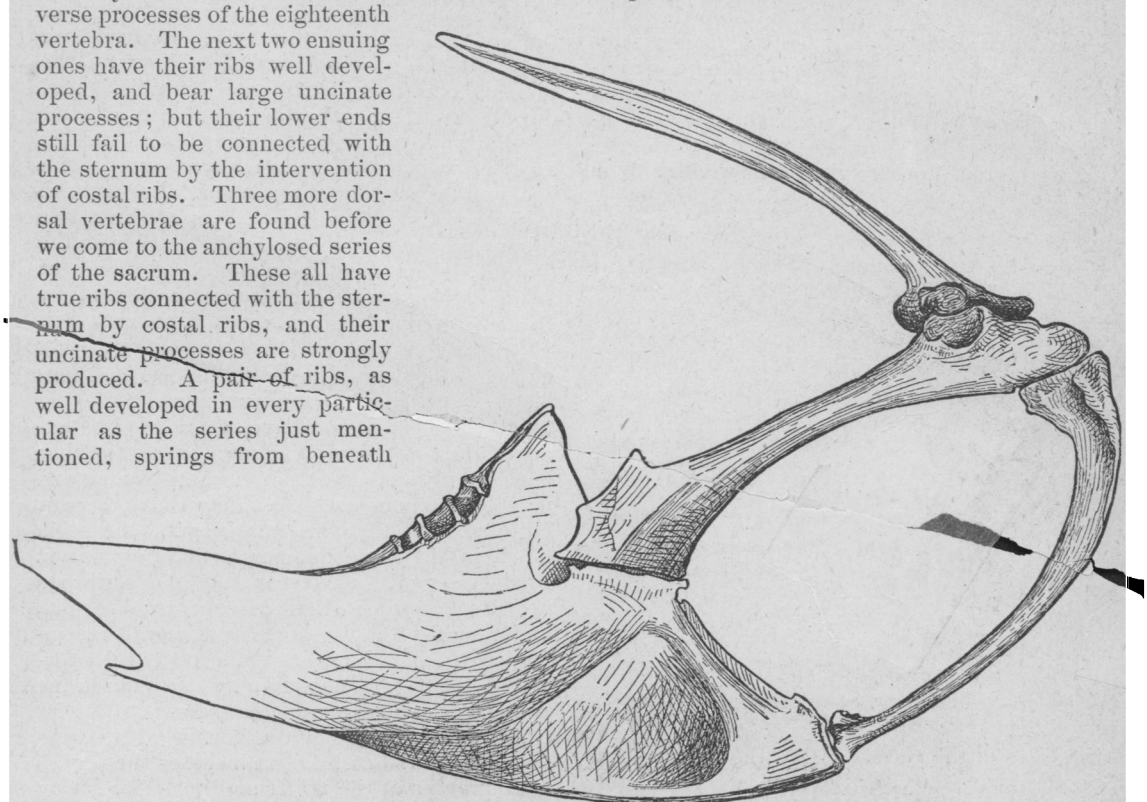


FIG. 2. — Right lateral view of sternum and shoulder-girdle of Phalacrocorax bicristatus, life size.

The keel is very much produced forwards, where, at its lower apex, it has a rough surface of some extent, against which the united clavicles abut. Sufficient material is not at hand for me to say whether anchylosis ever takes place at this point or not: it may do so, because we find in Aluco these bones usually unite at this point; but yet we come across specimens of this owl where the union is no more perfect than it is here. The hypocleidium of the clavicles, and the manubrium of the sternum, are both about equally feebly developed. The upper extremity of each clavicle has a very broad abutment for the head of the corresponding coracoid, to the inside of which expansion these clavicular bones throw backwards a scapular process; but they fail to reach these elements of the shoulder-girdle, as we find them

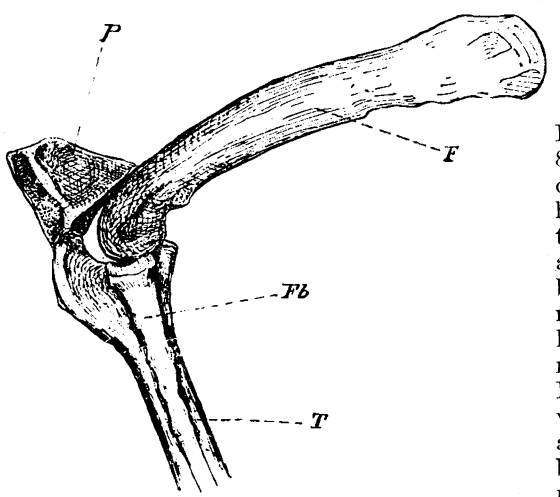


Fig. 3.—Knee-joint of Phalacrocorax bicristatus; right limb, life size. *F*, femur; *Fb*, fibula; *T*, tibia; *P*, patella.

in others of the class. All of the bones of the pectoral extremity, or the arm, are completely non-pneumatic, but otherwise well developed. Faint papillae for the quill-knobs of the secondaries are found along the entire length of the outer aspect of the ulna. The manus is composed of the usual number of bones,—one phalanx for index digit, two for the next, and one for the last.

In the lower extremity we find a femur of $6\frac{1}{2}$ centimetres in length; a tibia of $11\frac{1}{2}$; a metatarsus of 6; and the outer toe with five joints, measuring in all 10.7 centimetres. This limb is likewise non-pneumatic, in so far as its osseous structure is concerned. The fibula is carried unusually far down the side of its companion bone, to within 1.5 centimetres of the lower periphery of the outer tibial condyle.

The greatest interest, so far as the bones of the leg of this cormorant are concerned, centres about the knee-joint. Here we find a condition of affairs which is presented in my drawing. The femur, which is much roughened above for the attachment of muscles, articulates about equally with the leg-bones. In front of this joint is placed a very large and massive patella, of a pyramidal form, articulating with more than half its lower surface with the anterior and lower fifth of the femur, its inferior and anterior margin articulating at the same time with the upper border of the cnemial crest of the tibia. In front, we find that the groove that exists between the pro- and ecto-cnemial ridges of the tibia is produced on the entire anterior face of this patella, and, no doubt, the muscles of the leg are therein inserted, as in many divers. Such examples as this throw some light on such birds as Colymbus and Podiceps, where this bone becomes anchylosed with the tibia in the adult. I have not the skeleton of a loon at hand, to examine the process spoken of by Professor Owen ('Comp. anat. phys. vert.,' ii. 83), and followed by Dr. Coues in his osteology of the same bird ('Mem. Bost. soc. nat. hist.,' i. pt. ii.), as the analogue of the patella. The skeleton I have of Podiceps to examine does not show it; but it is one that has been in my collection for several years, and may have been lost. Penguins have a very large patella, that articulates with the tibia much in the same manner as it does here in Phalacrocorax. Professor Marsh describes a very large, free patella for Hesperornis regalis, and remarks that it bears a general resemblance to that bone in Podiceps ('Odontornithes,' p. 93). In examining this bone in the young of our cormorant, it seems to ossify from one centre. The ossification at the summit of the tarso-metatarsus includes the prominent process at the upper and posterior aspect of that bone.

Many other points of interest are to be found in the skeleton of the adult, as well as of the young of Phalacrocora xbicristatus, which space will not allow me to enter upon here: the leading points, however, I have endeavored to give, and these are always valuable when we wish to have them to compare with kindred forms.

R. W. Shufeldt.

THE ELECTRIC LIGHT ON THE U. S. FISH-COMMISSION STEAMER ALBATROSS.—I.

In pursuit of the hidden treasures of the deep, the work of the Albatross keeps her at sea many days at a time; and the operation

of dredging in great depths often carries the day's labor past midnight. To provide for these emergencies, which are frequent, and to afford ample illumination for the naturalists, not only in assorting the contents of the dredge as it is delivered on deck, but to illuminate their microscopes, delicate balances, etc., in the laboratory, the commissioner of fish and fisheries determined to employ the best artificial illumination the country afforded. As the vessel is essentially a steamer, using steam for every labor where it is practicable, the idea of electrical lighting from a dynamo-electric machine, driven by a steam-engine, was readily conceived, and an examination of the different systems was at once entered into. The Edison company for isolated lighting, we found, was prepared to enter into a contract for a complete plant, including the engine and the wiring; and being able to divide the light into eight-candle power lamps, besides giving guaranties, their bid was accepted.

The arc-lamp, though admirable for our deck, where a great quantity of light in a limited space is necessary, can never, from its great brilliancy, be utilized for twelve or fifteen naturalists, each at a special work, in the laboratory. It also occurred to the commissioner, that a lamp which could be lowered into the sea, to attract fishes, would be useful, thus affording another reason for preferring the incandescent light.

Fig. 1 shows the way in which the arc-lights are placed in circuit. And as each arc offers a considerable opposing electromotive force, it is necessary, in order to get light in a number of such lamps placed in series, to use currents of high tension.

Fig. 2 shows the incandescent lamps in multiple arc. The main wires, *a* and *b*, are tapped at pleasure, and the lamps are hung in the short circuits. The carbon threads in the lamps (described beyond) offer so much resistance that the current heats them to incandescence. The electromotive force in the circuit is low, which renders shocks impossible.

The plant on board the Albatross consists of an eight and a half by ten Armington and Sims engine, an Edison Z dynamo having its field-magnets vertical, a resistance-box in the circuit of the magnetic field, the main and branch wires, lamp-fixtures, safety-catches, and lamps.

The steadiness and uniformity of brightness of the lamps depend largely on the engine driving the dynamo; and the success of the system lies more in the attention paid to the engine, when the plant is correctly installed, than in any thing else. Uniformity of speed is the great object sought; and, to secure this, Mr. Edison has wisely adopted a high-speed engine with a sensitive governor, which is found in the Armington and Sims engine, represented in fig. 3.

The superiority of this engine lies in its well-

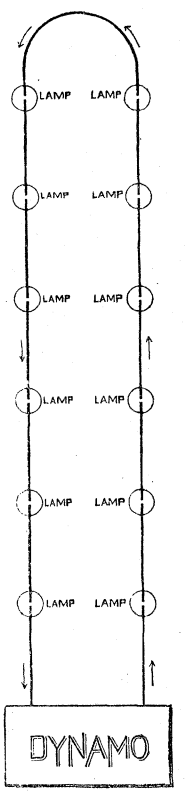


FIG. 1.

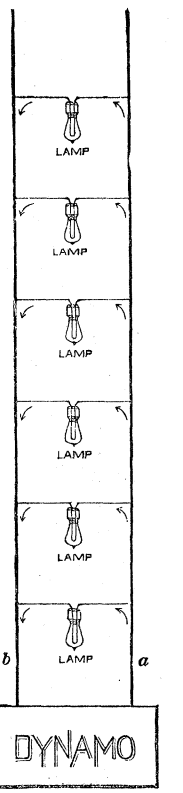


FIG. 2.

balanced working-parts, its relatively large bearing-surfaces, its sensitive automatic governor, and in its simple and well-balanced valve.

To secure high speed without the noise of 'thumping,' great lap has been applied to the exhaust side of the valve, whereby 'cushioning' is effected. This cushioning, or early exhaust closure, also effects a saving by retaining, in the clearance spaces, steam which would otherwise have been exhausted and wasted. To prevent an unequal expansion between the piston-valve and its chest, the castings are so made as to allow live steam to surround that part of the chest which surrounds

the working-faces of the valve, as shown in fig. 4, in which *S* shows the steam space, and *E* the exhaust space. By this arrangement

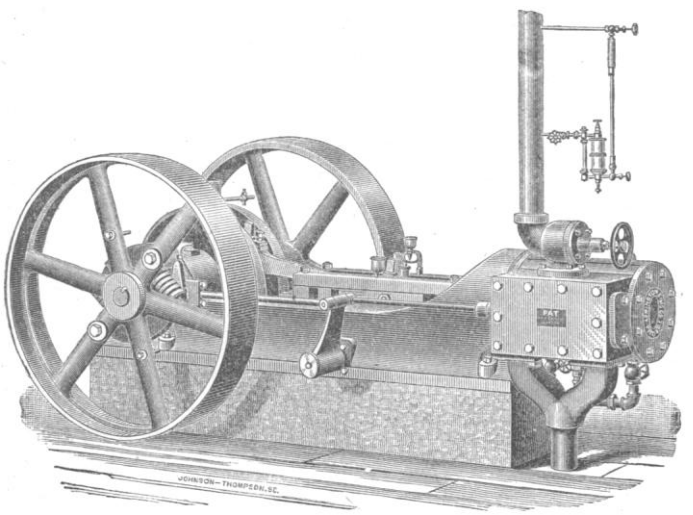


FIG. 3.

the valve-stem is packed against the exhaust instead of the steam pressure. The valve is ground to a sliding-fit, and, so far as I can ascertain, there has not been a particle of wear or leak during the ten months the engine has been in operation.

The governor of the engine, that part which makes it especially valuable for the purpose of electric lighting, is represented in fig. 5.

This automatic device is fixed in the fly-wheel, which is keyed to the shaft. There are two eccentrics, *E* and *F*, the one within the other, and both free to move on the axis. There are two weights, with their centres of motion opposite, and fixed in arms of the wheel. These

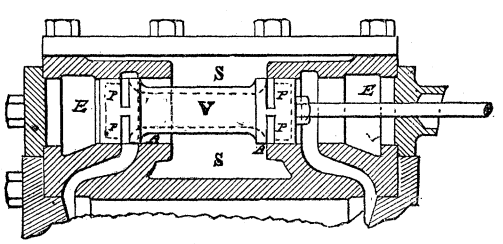


FIG. 4.

weights, *W*, *W*, are connected, each to an eccentric, and are connected together by an arm or rod. Springs are provided, to resist the centrifugal force of the weights. The system is so constructed that any centrifugal motion of the weights will throw one eccentric ahead and the other back, thus diminishing the throw of the eccentrics, and effecting a shorter cut-off without altering (within working limits) the lead of the valve. The engine used on board the Albatross has eight inches and a half diameter of cylinder, and ten inches stroke of piston: it runs without noise, three hundred revolutions per minute, requiring no more attention than the oiler can give it in addition to his other duties. When the main engines of the Albatross are in motion, a boiler-pressure of sixty-five pounds is often used, and twenty-six inches of vacuum is scarcely above the average. Lying in port, the boiler-pressure is kept at about twenty-five pounds; and, notwithstanding this great range of pressure, the governor regulates the dynamo to three hundred revolutions per minute, as closely as I can measure it.

In selecting a good engine, Edison has, to my mind, displayed as much genius as in using the Siemens form of armature for his dynamo.

The engines are placed on the starboard side

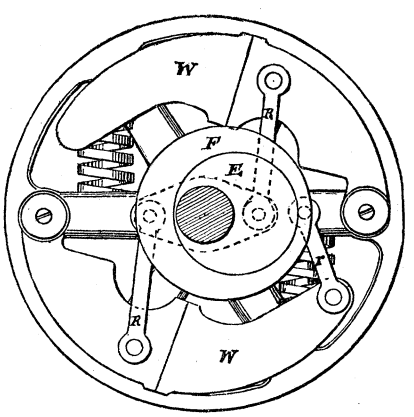


FIG. 5.

of the main engine-room, the engine taking steam from the main boilers, and exhausting into the main condenser.

The dynamo used on board the Albatross is

known as the Z dynamo, and is installed for what is called a B circuit. It has its field-

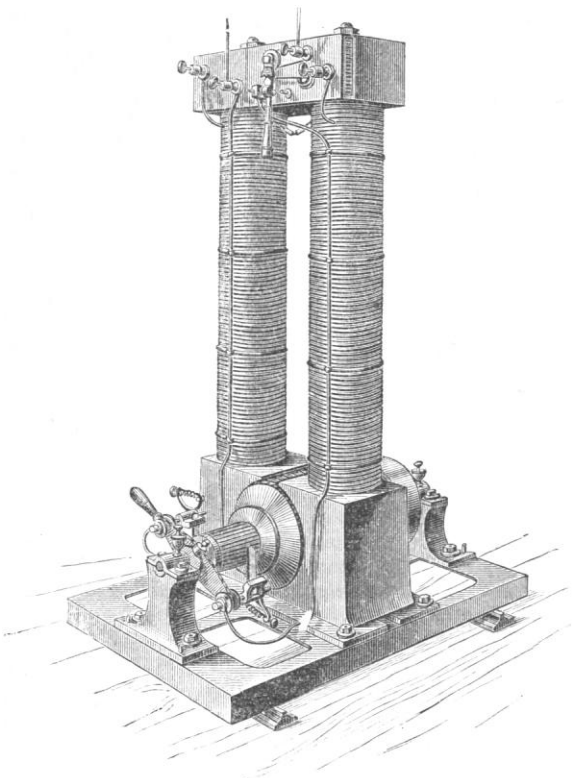


FIG. 6.

magnets vertical (fig. 6), and its armature revolves on a horizontal axis in the magnetic field. The field-magnets are arranged on what is called a 'derivation' from the commutator, placing it in the circuit, as in the Siemens system. In adopting and utilizing known principles and devices, Edison has worked out the details to a state of perfection simply admirable. Wherever the eye rests, it is pleased by correct proportions, sound mechanical ideas, and agreeable outlines.

The armature, on Siemens's principle, is mounted on a wrought-iron shaft. About the shaft, and concentric with it, are circular cylinders of wood, separating copper plates, as shown in fig. 7. Between the plates *a* and *b*, and also between *c* and *d*, there are annular disks of copper, insulated from each other. Between the plates *b* and *c* are similar but very thin annular disks of iron, separated from each other by tissue-paper. This built-up cylinder is then bolted together longitudinally; the bolts passing through the thin iron and copper disks without touching them, but clamping them between the thick plates. Wire bundles or bars are placed equidistant from each other longitudinally, around the cylinder, connecting each a pair of the copper disks, i.e., one at each end; and these bars or bundles generate the current.

Bars of brass or copper, separated by thin sheets of mica, *e*,*e*, are dovetailed into the projecting end of the cylinder, which forms the commutator. The resistance of the generator is thus small, and allows great subdivision of the current in multiple arc.

To preserve the uniformity of the current, an adjustable resistance-box is placed in the circuit of the field-magnets; and, when a number of lamps are extinguished, additional resistance may be added to the field by a switch on this resistance-box, whereby the internal and external resistances are balanced, preserving not only the uniform brightness of the lamps, but also the economy of the machine. A test-lamp is suspended on the dynamo; and the fireman, who oils the engine, regulates the resistance according to the brightness of this lamp. Automatic regulators have been devised; but as it is necessary to employ a man to run the engine and dynamo, and as the incandescence is more frequently altered by slipping of belts than by the sudden turning-out of a large number of lamps, the same man can attend both:

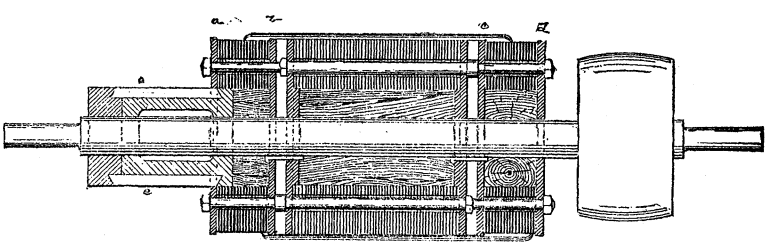


FIG. 7.

consequently the simple resistance-box answers every purpose on board ship.

(To be continued.)

THE AMERICAN EXPLORATIONS AT ASSOS.

The excavations in the ruined Greek city of Assos, in the southern part of the Troad in Asia Minor, have been completed; and the members of the expedition have returned to this country. This gave occasion recently to call in Boston a special meeting of the Archaeological institute of America, under whose auspices the work had been carried on, at which Mr. J. T. Clarke, the leader of the expedition, was to give an account of his investigations. Unfortunately, Mr. Clarke was prevented by illness from attending; but this was less to be regretted, because it gave the president of the institute, Prof. C. E. Norton, an opportunity to express, more fully than he could otherwise have done, his sense of the extremely satisfactory manner in which Messrs. Clarke and Bacon had conducted the investigations at Assos.

Too strong terms could not be used to describe the devotion and self-sacrifice, as well as energy, which they had brought to the work, almost to the point of denying themselves the necessaries of life, that the resources of the institute might be diverted as little as possible from the work in hand. They had also labored in a spirit of enthusiasm and intelligence, bringing to bear the methods of modern scientific research, which gave to the results obtained an accuracy and value far beyond that of most of the archeological work of the past. No better archeological work had been done anywhere. He felt sure, that, when the final report upon the explorations at Assos should be published, it would be not merely up to the level of such publications, but would mark an advance in the science, and would take high rank among standard archeological works. This final report would require deliberate preparation: it was desirable that it should be exhaustive, and be published in a fitting style, as a monumental work.

The investigations had been carried out in the most thorough manner; nothing had been left undone which it was desirable to do; and, even had unlimited funds been at the disposal of the expedition, the excavations would not have been carried farther than they had been. The results were mainly architectural. A far more thorough knowledge of the civic buildings of a Greek city than was before possessed had now been obtained. Few marbles had been found (most of them having been previously destroyed), but a large number of terra-cottas were secured. The accession to the body of Greek inscriptions was real, though its importance was not to be exaggerated. In numismatics the expedition had been very successful; a very large number of coins having been found, and the number of types of Assian coins known, largely increased. In all, forty or fifty cases of antiquities would be brought home as the share of the institute. These included the best of the temple sculptures; the Hercules block and the best sphinx; all of the inscriptions, with the exception of the bronze tablet; a large number of terra-cottas; most of the coins, and a considerable number of minor objects, found in the tombs. Among the many architectural fragments, there would be enough to erect a complete order of the temple at the Museum of fine arts. The two thousand dollars which that institution had voted to appropriate for the purchase of a portion of the antiquities belonging to the Turks would fortunately not be called for, as the latter absolutely refused to sell any thing. Hope is, however, entertained, that a gift of these articles may be made by the sultan. It was pleasant to be able to announce that the whole work had been carried on with absolute honesty, and that the Turks had been dealt with in every way as strictly as if they had been Americans.

The final report would embody the results of all this work, published in an authoritative and reliable form. In the mean time a preparatory report would be issued, giving an account of the work done subsequently to the publication of the first volume on Assos. To prepare this report, it would be necessary for Mr. Clarke to go to London in order that he might have access to the British museum, the only place where the necessary materials could be obtained. It was desirable that the institute should retain both Mr. Clarke and Mr. Bacon in its employ until the Assos material had been entirely worked up.

The treasury of the institute was very nearly empty; and it was proposed to hold a general public meeting, at which Mr. Clarke, and other gentlemen interested in the subject, should speak, with a view to awakening such an interest in the community as should enable the institute to raise the sum of money required.

At this meeting, held Oct. 31, Prof. W. W. Goodwin read a report of the first year's work of the American school for classical studies at Athens, founded a year since by the Archaeological institute in connection with several of our colleges, and of which Professor Goodwin was last year the director. As this report affects rather the philological than the archeological student, and will be printed elsewhere, we proceed at once to the main feature of the evening, the address of Mr. J. T. Clarke, who spoke substantially as follows:—

Assos was a small town, — small even for antiquity, when cities were very far from the enormous dimensions of modern capitals. The number of its inhabitants can never have greatly exceeded twelve or fifteen thousand; but its interest and importance can by no means be judged by that of modern towns of equal size. Athens itself, at the time of its greatest extent and power, is known to have had only ten thousand houses, and twenty-one thousand free citizens; and this figure included the entirely separate harbor-cities of Munychia and the Piraeus. To take a more recent example: the imperial city of Augsburg, at the epoch of its chief historical fame, under Maximilian, had only sixteen thousand inhabitants, — was only about the same size as Assos.

Our work gives as perfect a picture of the life of a quiet provincial Greek capital as the recent brilliant excavations at Olympia display the character of a great place of public festal assemblage. The investigations differ in scope; but I trust that ours has been not inferior as regards thoroughness, and, in some important respects, not as regards the nature of its results.

The first report, which is in your hands, represents three months' excavation. We have now the results of two years of hard work to add to it; and these results have been fully proportionate. The first report was restricted, in the description of buildings examined, to the temple and the Greek bridge. To our knowledge of these structures so many additions have now been made, that our restorations may be said to be as nearly perfect as it will ever be possible to attain. The temple, already better known than any building discovered in a similarly ruinous condition, appears as perfect an example for the history of Doric architecture as many which are standing to the top of the entablature. Other fragments of the reliefs carved upon its epistyle, the importance of which to the history of Greek sculpture is now recognized by all scholars, have been found since the publication of the report, and the entire stone ceiling of the building has been recovered. To this have been added many details, including most interesting and curiously suggestive observations concerning antique stone cutting and laying.

Our knowledge of the geography of the land has been further enriched by maps, geological as well as topographical. To the story of its archeological recovery many details have been added, while its political history has received most important additions. One of these latter points I may be permitted to mention, because of its striking character. Assos is the first city of Greek civilization mentioned in documental history. The so-called Sallier papyrus, now in the British museum, records, that among the confederates who came to the aid of the Hittites, — those famous men whose empire is the pride of Professor Sayce, — were the 'people of Pedasa.' The inhabitants, then, of our city (Pedasos, Assos), were, in the fourteenth or thirteenth century B.C., of sufficient importance to be enumerated, with the Dardeni of Iluna (i.e., the Dardanians of Ilion or Troy), among those forces which appeared at Cadesh, on the banks of the Orontes, to fight against Ramses III. — the Rhampsinitos of Greek story — in the fifth year of his reign. The importance of this curious notice, in an historical point of view, is hardly to be overrated.

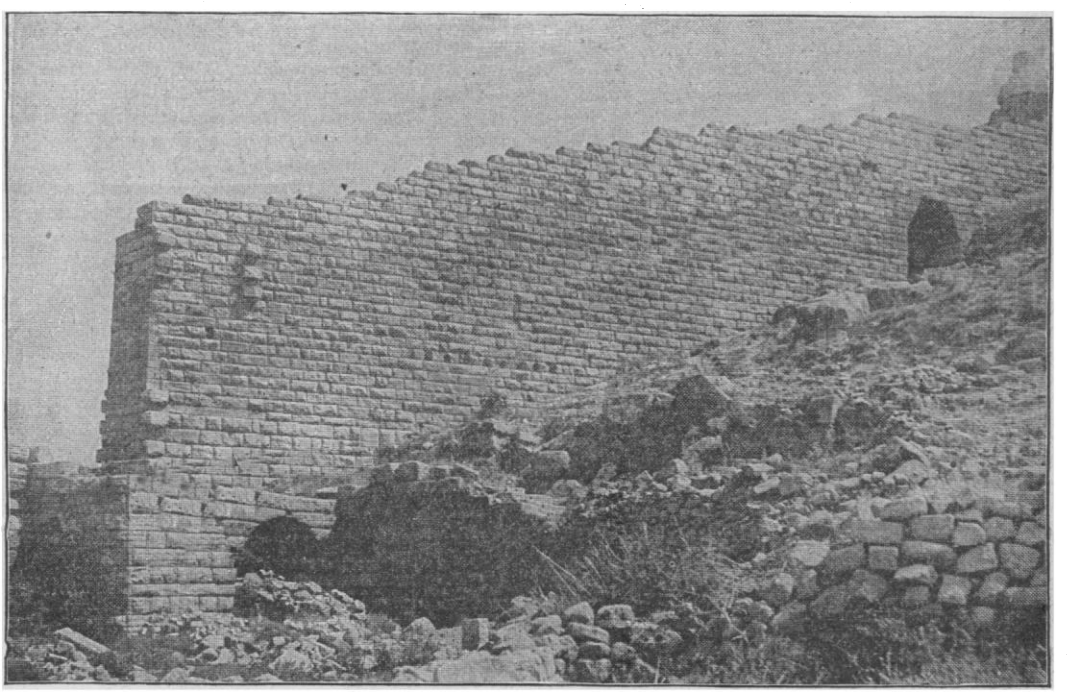


FIG. 1. — City walls of Assos, dating from the fourth century B.C.

The digging of the second and the third years has been almost restricted to the lower town. Much work was done upon the fortifications of Assos, the finest known works of Greek engineering. The oldest inhabitants settled close around the acropolis, building rough walls of enormous blocks, not cut by any metallic tools, upon the levels just at the foot of the volcanic crater, and there did a great deal of terracing, which was cleverly used by the later Greeks. The first outer circuit-wall remaining (I. in fig. 2) was certainly old at the time of the Lydian invasion. Under the favoring influences of the Aeolic colonization, the city greatly increased, and a new wall was necessary. This second masonry (II., fig. 2) may have somewhat antedated the Persian wars. By reason

of the troubles brought by the Persian occupation of the land, the city declined; and when, under Lysimachos, its walls were rebuilt, the entire enclosure north of the acropolis was relinquished. The walls partially overthrown by sieges were not considered of sufficient value to be worth repairing, and a connecting-wall was built to the acropolis. This noble mass of masonry of the fourth century B.C. (fig. 1), rising in many places to some sixty feet in height, was joined so accurately that the blade of a pen-knife cannot be introduced between the stones. It was this portion of the wall that gave Col. Leake his well-known opinion that Assos was the finest representative of a Greek city in existence. Under the favorable dominion of the Romans, the commercial city greatly increased, and finally re-occupied the space north of the acropolis; new escarps (III., fig. 2) being built in front of the old walls, and enclosing them entirely. But to enter in any degree into details would lead us too far afield, ranging, as the fortifications do, through a thousand years, down to the time of Constantine; for the masonry in some parts, especially towards the eastern side of the city, closely resembles the ramparts of Constantinople.

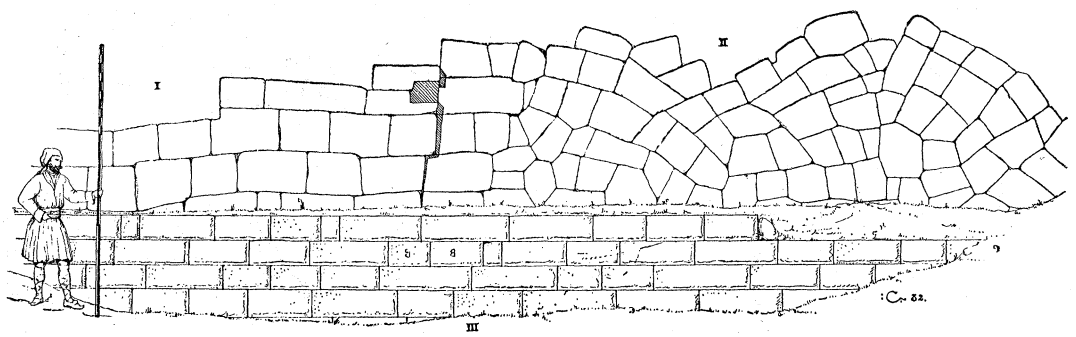


Fig. 2. — Corner of oldest polygonal city wall (I.), with extension in irregular masonry antedating the Persian wars (II.); both reveted, after the age of Lysimachos, with an escarp of squared blocks (III.).

The buildings of the agora, or market-place, of Assos, are so interesting and well connected that they are superior to those of all other Greek cities; and, notwithstanding the elaborate works of the many writers who have investigated and described the market-place of Pompeii, we may unhesitatingly assert the agora of Assos to be not only more interesting, but more completely known, than the forum of that city. The enormous stoa, or colonnade, a hundred and ten metres in length, was built, it may be with reason assumed, by the architect of that surrounding the temple of Athena Polias at Pergamon, which has so recently been excavated. It is constructed of the stone of the acropolis, an andesite much resembling granite; and a comparison between the forms given to this material and to the marble mouldings of Pergamon is most instructive. Being ceiled with wood, it needed only one support behind every second column of the front. Next to it, and apparently of the same date, is the bouleuterion, or building in which the archives of the city were kept. It is worthy of note, that most of the inscriptions were found in the slides of earth beneath this part of the agora, evidently having been thrown down during the troubles of the city. The building is exactly parallel in character to the only other bouleuterion known, — that in the Altis at Olympia; or, rather, it is like the inner portion of that structure, there being at Olympia halls on either side of a central structure like the bouleuterion of Assos.

The building which borders the agora on the south is absolutely unique. It is the only instance of a Greek bath known, and the only four-story ancient building ever recovered. Fortunately, we have been able perfectly to restore it. Its arrangement is extremely curious and interesting. It consisted of an enormous hall going through two stories, with twenty-six chambers upon its side. Above this entire structure was a colonnade, the floor of which was upon the level of the agora. In front of the stoa was an enormous basin for the reception of water, covered by stone lintels, and paved, so that it was not visible to the persons on the market-place. From it ran a subterranean conduit to the lower story of the bath-room, and there were arrangements for the water to flow into the thirteen lower cells. The refuse-water was then led into a larger basin beneath the bath-building. There was another reservoir to receive the water from its roof. This connected with the street, and so formed an enormous fountain, giving pure water for the consumption of the people; while the water of the refuse-basin adjoining it was used for the cooling of the theatre.

Next to the bath was built, in later times, a small heroön, in which the bodies of the benefactors of the city were deposited, their names being inscribed on the entablature. We opened three sarcophagi, which contained only strigils, small vases, and the bones of the dead.

The changes of plan observable in the agora are peculiarly interesting. In early times there was an inclined plane ascending from a lower street to its level; but, when the heroön was intruded, the passage became so narrow that it had to be turned, and transformed into a stairway. Two fine mosaics of comparatively early date were found just below the

retaining-wall. The larger represented Victories carrying votive offerings towards tripods, with a seller of love-gods as centre-piece; the other was bordered with geometrical figures, enclosing couching griffins, — the coat of arms of Assos. At the east of the agora was the bema, the stand-point of the orator in addressing a crowd; the level of the place being there raised above the market, and flagged, while the remainder, like all Greek streets before the Christian era, was unpaved.

Of the other buildings of the lower town, I may say that the theatre is now as well recovered as any theatre in Asia Minor. Because of certain peculiarities of the stage, its recovery is peculiarly valuable to the history of the Greek theatre. The gymnasium, at the west of the town, is equal in preservation and interest to the building of that character at Olympia, — the only one hitherto known. Noticeable, also, is a great atrium, of late date, but showing the preservation of Greek forms far into the Roman period, the arch appearing with purely Hellenic details. In the lower town of Assos there were no less than seven Christian churches. The street of tombs is perhaps the most interesting burial-ground of the ancients as yet thoroughly investigated. It presents monuments of every period. One, notably, cannot be later than the seventh century B.C., and many are as recent as the eleventh or twelfth Christian centuries. In this necropolis is a mausoleum which presents a perfect parallel to the tombs of the kings at Jerusalem. We opened a hundred and twenty-four sarcophagi for the first time, and found many burial-urns. There seems to have been a mixed system of inhumation and cremation, according to the temporary fashion. We also found great numbers of figurini, small vases and glasses, among them some beautiful specimens of thin transparent glass, and several thousand coins. Many other smaller articles of more or less value were found in the tombs; but the inhabitants of Assos, though they must have been wealthy, did not commonly place their best ornaments with the bodies of their dead.

It is my duty, as well as pleasure, to speak of the most creditable part taken by the members of the expedition not present here this evening. Of Mr. Bacon's really extraordinary ability as a draughtsman I have no need to speak. His unremitting labors secured the success of the expedition. The highest praise is due also to Mr. Koldewey, an architect from Hamburg, who worked with us for a year and a half from pure love of science, and was of the greatest possible assistance. My learned friend, Dr. Sterrett, has edited seventy-five or eighty inscriptions found by us, studying them upon the spot. Thanks, too, are due to our photographer, Mr. Haynes, and to Mr. Diller the geologist, who has already made known his work in valuable publications. Other members of the expedition, who were with us on comparatively short visits, worked as well and conscientiously, with results commensurate to the time they spent at Behram.

Archeology, up to within a recent date, hardly deserved the name of science, having been a merely empirical recital of facts, without connection or true historic method. To-day it has conquered a foremost place among the exact sciences of determination; and we trust that the study of the best methods of all previous investigations has enabled the expedition to Assos to be in every respect creditable to the American name. An instance of this special perception and direct search for materials bearing upon our knowledge of the development of various phases of ancient art may perhaps be seen in the fact, that two of the most interesting links that could be desired for Greek architectural history have been found, — a proto-Ionic capital, which stands between the ornamental spirals of Mesopotamia and the perfected Ionic capitals of the erechtheion; and a proto-Doric shaft with a base, which proves with equal certainty the derivation of that column from the tombs of Beni-hassan.

The work of the institute at Assos labors under one signal disadvantage: its results must be long awaited by those high-minded furtherers of science to whose munificence its execution is due. This disadvantage is indeed inseparable from all such undertakings of great extent; but on the other side of the Atlantic, where archeological investigations are carried on in greater part by the various governments, it is much less felt than here, where a large body of private individuals has maintained the work. There, the verdict of a commission of experts is entirely sufficient to the minister of public instruction, who has supplied the funds, and placed the diplomatic influence of the nation at the disposal of the work; and after this is given, a delay of ten or fifteen years in the publication of the results is not looked upon as a drawback. Here, however, the circumstances are different in every respect; and as it has naturally been impossible to give in half an hour any adequate account of the hard work of two long years, it only remains for me to beg for a further extension of credit. The debt shall be paid as soon as it is possible to write the proposed reports; and it will not have escaped your observation, that one object of the present meeting is to so interest you in the work of the institute, and convince you of its value, that the trifling sum required for these publications may be forthcoming.

At the conclusion of Mr. Clarke's address, Prof. W. R. WARE of New York was called upon, as one who had visited Assos for the express purpose of seeing what had been accomplished by the expedition. Professor Ware spoke as follows: —

It was, as you may believe, with special pleasure, that I found myself, in May of this year, passing through the Pillars of Hercules, my face towards the east, with the Troad as my objective point. But it was not until the third week in July, that, like St. Paul leaving Alexandria Troas, we came to Assos, though we were not, like St. Paul, 'minded to go afoot.' Perhaps it would have been better if we had been; for the modern Trojan horse is a small, ill-tempered, not always sure-footed, beast, who requires, indeed, often as much urging and pushing as did his Homeric namesake.

St. Paul probably passed through the valley of the Satnioeis, which flows into the Aegean on the west side of the Troad, a few miles south of Alexandria. But if he had known what was good for himself, in this world, he would have done as we did, and, leaving the plain, have ascended the steep sides of the little mountainous hill which separates the valley from the southern shore. There we found, upon the top, a tolerably level tableland commanding views of most surpassing beauty; to the north and west, Samothrace and Imbros and Lemnos, with Mount Athos just discerned in the western horizon on the other side of the sea; then, to the south, Lesbos, across the strait; and finally, in the gleaming morning sea, the little black hill which marked the volcanic mountain which was the goal of our endeavor.

The mountain of Assos is so steep as it rises out of the sea, that within a distance of half a mile it reaches a height of nearly one thousand feet. The steepest parts of the bridle-paths upon Mount Kearsarge and Mount Washington are not steeper than the road from the sea to the temple on the summit; and the agora, the market-place, which has been described to you, the centre of the city, is five hundred feet above the water.

One finds himself there, as you may now imagine, as on the stage of some classical theatre with all its scenes still standing, — here, the bouleuterion; there, the gymnasium, Mr. Koldewey's stoa, Mr. Clarke's temple and city walls, and, lastly, Mr. Bacon's street of tombs, leading half a mile away, towards his bridge at the river.

But interesting and exciting as is the presence of these monuments of antiquity, one can hardly keep his mind upon these things, for the attractions of the scene before him. To the east, where the long slopes of Mount Ida descend to the sea, the line is taken up by the blue and rose-colored mountains of Asia Minor, stretching along toward Smyrna; toward the south, filling the southern horizon, the island of Mitylene, — the mountain-tops brown in the sunlight, with purple shadows lying in all the valleys, and everywhere encompassing and infolding it all, the wonderful blues and greens of the Mediterranean Sea. Splendid as is the view from the acropolis of Athens, — the most famous in the world, — it seems to me that the view from the heights of Assos surpasses it in loveliness and splendor; and these buildings seem to have been so set, that this unparalleled prospect could be enjoyed to the utmost.

The buildings themselves are constructed of a stone which in its general aspect resembles a fine-grained granite, but in color and hue is more like the darkest and most purple of the Connecticut freestones. Yet the grain is so smooth that the most delicate mouldings can be cut upon it; and one is surprised to find, in passing the hand over the surface, how sharp, clean, and refined are the profiles of the mouldings.

The architectural interest attaching to these remains is unique. And here I cannot do better than to read an extract from a half-finished letter which I found in Mr. Bacon's portfolio, and snatched from oblivion, — a letter dated in December last, and never finished: —

"As the end approaches, my work has assumed a more definite form; and I know pretty well what the results will be. Hitherto I have been working rather blindly, and with but hazy ideas of final results. The street of tombs is such a collection of small, isolated ruins, that any thing like a complete idea of the original disposition was impossible at first. Sobered by the experience of last year, I this year attacked the monuments separately, with a resolute disregard of their relation to each other; excavated the most worthy, and drew them out in plan, elevation, and detail; then located each in a general survey, strung these plans along on a large map; and, lo, order is come out of chaos! Where before seemed nothing but confusion, now appears the hand of man; and the tombs are placed with such a picturesque regard for their purpose and for each other that the appreciative soul is filled with delight. The existing plan is more complete than the Appian Way at Rome, nearly as well preserved as that at Pompeii, and, to my mind, far more interesting than either, for it is pure Greek in every line and detail. Indeed, that may be said of all the work at Assos. There does not seem to be the slightest Roman influence. Of course, it is not always faultless. Work there is of all kinds, good, bad, indifferent, but, good, bad, or indifferent, Greek, not Roman. This absence of Roman feeling in the later work is a very peculiar thing. In Pergamon, Smyrna, and all the cities of Asia Minor, there exists a great deal of Roman work, and most of it pretty bad too. But here the bulk of the people probably never understood a word of Latin. The number of Latin letters upon the inscriptions we have found could almost be counted on your fingers. Whenever the Roman governors had any thing to say, they had to say it in Greek, to be understood. Even on the tomb of the Publius Varius family the dedicatory inscription over the doorway was in Greek.

"This absence of Roman work shows pretty well what a provincial town this must always have remained. Their stonemasons, builders, and architects were born and bred here; and they were a conservative set, with old-time notions about clamps and dowels, and about running down to the ledge for foundations. All this can be read like a book in the buildings we have laid bare. When any thing extra was to be 'run up,' they didn't import a foreigner from Miletus or Ephesus with his new-fangled ideas; not at all: they built it themselves. And this was not owing to lack of money, for the remains show that Assos must have been a wealthy city."

Another point of great interest is this, — almost all the principal publications of Greek work that have been made relate to monumental buildings. We have the temples, volume after volume, exhibiting a complete system of Greek architectural construction and design; but they have left unanswered the questions, how far Greek architecture was confined to sacred buildings, and to what extent the principles and methods which are exemplified in so magnificent a manner in the temples and sacred monuments were carried out in other structures. The long series of secular buildings which have been discovered at Assos offer the best answer that has yet been given to these questions; and the publication of the work, when it comes to be made, will mark an era in the study of the municipal and military architecture of the Greeks. It is a question, moreover, not without practical interest to the working architects of to-day, who are striving to solve for themselves the problem of fitly applying to secular and domestic buildings the same architectural forms, and the same principles of design, which they apply to sacred and monumental structures. This is an

ever-recurring problem; and it cannot but be of service to learn how the Greeks, masters of the art, solved it in their own case.

Besides the walls, the buildings, and the tombs, there have been found, as Mr. Clarke has explained, a considerable amount of smaller objects, — vases, glass, pottery, urns, etc.; and of these a considerable portion has been secured as property of the institute. The *firman* by which the excavations were authorized gives us one-third of the objects found, — the most interesting third, perhaps; but it is difficult to speak justly in regard to it. If anybody should maintain that the objects which are to come here are of surpassing interest, and that they will immediately lift our museum to the front rank of such institutions, a decided negative would have to be given to such aspirations. If anybody should assert that the things were not worth the cost of transportation; that they have no general or popular interest; that they belong to a poor period; that they are hardly fit to be seen beside the more beautiful works, which, in the original and in copies, are in our possession, — that, again, could not be for a moment admitted; for the fact remains that the small portion which is secured to us is of surpassing interest to those who take an intelligent interest in such things at all.

The lower drum of a column, the capital, a complete section of the entablature, including the unique sculptured architrave, the frieze, and the cornice, all have been secured, and may soon be placed in position. In addition to that, the best of the sculptures which were discovered are to be brought over; almost all the coins; among the glasses and vases those which, on the whole, were best worth preserving; and most of the inscriptions. But even if the objects secured to us from the discovery were less than they are, it would make little difference in our estimate of the success of the expedition. The real result was intellectual. And the new points which have been proved, the new discoveries which have been made, are such, that, if not a single object were brought here from Asia Minor, we should still have abundant reason to be satisfied with the results achieved. It is impossible that we should obtain any adequate idea of these from the few drawings that have been publicly shown. They are but a fragment of the whole.

How it was possible for these two or three young men, while occupied with the practical direction of from twenty to forty men, to make the surveys and supervise the excavations, and also to prepare the immense mass of drawings which have been executed, it is difficult to understand; and it furnishes abundant proof of the ability and devotion with which the work has been prosecuted. The nature of the results will be seen when the next annual report comes from the printer; but their whole value and importance cannot be estimated until the appearance of that final and monumental work which will, we may hope at no distant day, take rank among the authoritative publications of its kind.

I may add, that the increasing interest in archeological work, and the scientific and precise manner in which it is now conducted, give new encouragement to the prosecution of literary classical study. The competition between the literary and scientific method seems about to end in a reconciliation, in the prosecution of literature on scientific principles, and in allying archeological science as closely as possible with the literature of classical antiquity. Archeology is a common ground on which science, literature, and art meet and join hands, each helping the other. Such a school as that now established at Athens, which you are asked to favor with your approval, is their common home.

On motion of the Rev. Phillips Brooks, the meeting declared, by an enthusiastic vote, that the work of the institute should be generously supported.

THE AMERICAN ORIENTAL SOCIETY.

THE autumn meeting of this society was held in New Haven, Oct. 24 and 25. Letters were read from various members abroad, reporting progress in their work; among others, from Mr. Mills of Hannover, respecting his edition of the Old Persian Gathas (ancient Zoroastrian songs or odes), of which the first volume is printed, though not published.

A paper on the temple to Zeus Labranios in Cyprus was read by Mr. Isaac H. Hall of Philadelphia, one of the pioneers in Cypriote studies, and the chief authority on the Cypriote language in this country. A temple to this deity exists at Mylasa in Caria (described in Fellowes's 'Lycia'). He was, under the name of Zeus Stratios, a local deity of the Mylasians, certainly from the time of Darius to that of Lactantius. The only other temple to him is this one in Cyprus, at Fasuli (or Fasula), near Amathus. The notoriously Lycian-looking architectural and other art remains found in the neighborhood show that this part of Cyprus was settled by Carians from Mylasa or its vicinity. Mr. Hall derived the epithet 'labranios' from a Lydian, Carian, or Lycian word, 'labru' (preserved by Plutarch in the form 'labrus'), meaning 'axe,' the axe being the peculiar symbol of Zeus Stratios of the Mylasians. From this word came the Mylasian name 'Labranda' ('place of the axe'); but the Carian settlers in Cyprus dropped the *d* (which is a sort of locative termination), and called their deity Zeus Labranios; that is, the Zeus Stratios of the Mylasians, and not Zeus Labrandios, which would be the Zeus of the village Labranda. Lycian influence in Cyprus seems confined to this little part of the island.

Mr. Hall also read (supplementing it from his own knowledge of the facts) a short history, from Dr. Van Dyck of Beirut, of his Arabic translation of the Bible, — a version admirable in literary style and in typographical execution (printed at the American press in Beirut). The difficulties in the way of the production of this translation were very great, and the result is highly creditable to American scholarship and energy.

Professor Avery of Bowdoin college gave an analysis of the Khasi language, spoken by a people dwelling in the Nepaul Hills, a representative of the non-

Aryan dialects which preceded the Sanskrit in India. It has no inflections proper, but uses prepositions for the expression of case-relations, and forms tenses very much in the same way as the English. It is noteworthy that this language, though a slightly developed one, has a clear distinction of gender; but the value of gender-distinction as a linguistic differentia is not yet well made out. In common with most of the languages of eastern Asia, the Khasi has a system of tones. The same thing is true of the Siamese, on which Mr. George presented a paper, illustrating the tonic distinctions by a short Siamese reading.

The paper of the most general interest was one on the origin of the Phoenician alphabet, read by Mr. J.P. Peters of New York. For some years past, most students of the subject, accepting for the present the conclusions of the late Vicomte E. de Rougé, have been inclined to derive the Phoenician from the Egyptian. This conclusion is based on the close relations existing between Egypt and Phoenicia in historical times, and on the similarity between certain letters in the two alphabets. But recently the Babylonian-Assyrian alphabet has begun to press its claims to be considered the parent of the Phoenician. It is almost certain that Phoenicia was closely connected with the Tigris-Euphrates valley at a time earlier than the oldest known historical monument. As long ago as 1877, a German scholar, Deecke, came forward as the champion of the Babylonian alphabet; but he committed the anachronism of deriving the old Semitic or Phoenician from the more modern 'cursive' cuneiform. Mr. Peters took the most ancient cuneiform signs, and compared them with the oldest Phoenician, finding in several instances striking resemblances. He urged besides, against the Egyptian origin, the fact that the Phoenician alphabet contains no vowels, while the hieroglyphics have distinct vowel-signs [though this is true of the Babylonian also]; and, further, the fact that the Egyptian had a large number of different signs for the same sound, and would present greater difficulties in the way of deriving an alphabet than the Babylonian, which had fewer homophones. The question is yet far from being settled, one serious obstacle in the way of the Assyriologists being the difficulty of determining the oldest forms of the cuneiform writing; but all such sober investigations as that of Mr. Peters must advance the desired solution. Meantime the Egyptologists, on their part, are bringing forward new material.

The edition of Manu, which was undertaken by the eminent English Sanskritist, Mr. Burnell, has been committed by the publishers, since his death, to Mr. E. W. Hopkins of New-York City, who sent on two papers, — one on the Nandini commentary on Manu, the other on the quotations from Manu in the Mahabharata. The former was a defence of the commentary in question: the latter was a contribution to the criticism of the Manu text. Mr. Hopkins took those passages in the Mahabharata which are introduced by the phrase, 'Thus said Manu,' and, finding that they do not always agree with the existing text of the laws, concluded that both texts rest on an older tradition; that Manu was an ancient sage, with whom tradition connected a number of laws, whence grew the collection called by his name.

Professor Whitney read on the variants of the Sama-Veda, coming to the conclusion (against the position of Benfey and Weber, hitherto generally accepted), that, in most cases in which the Sama text differs from that of the Rig, the latter is entitled to the preference. Professor Bloomfield of Johns Hopkins university, who is engaged in editing the Kauçika-Sutra to the Atharva-Veda, sent an account of the manuscripts of the Sutra in his hands, most of which he had obtained through the kindness of English officials. Mr. Brown made a short report of the recent Oriental congress in Leiden, at which he was present.

The next meeting of the society will be held in Boston, May 7, 1884.

LETTERS TO THE EDITOR.

Geology of Philadelphia.

Dr. Persifor Frazer's explanations of his use of the term 'hydromica slate,' in his Lancaster-county report, as either 'not an equivalent for hydromica schist' or as a 'misprint,' renders it evident that he has changed his opinions since the writing of his report on York and Adams counties. In that volume the term 'hydromica slate' is employed ten times or more to designate 'hydromica schists,' and in several instances the terms are used synonymously. In two instances, localities marked in his printed section as hydromica schist are referred to in the accompanying descriptive text as hydromica slate (v. sections 2 b, 4, and p. 94, 101). As is evident from the context in a number of places, his 'hydromica slate' does not mean 'chlorite slate,' but 'hydromica schist' as it is elsewhere called (v. p. 83, 142, etc.).

There is, however, equal objection to his use of the term 'chlorite slate,' frequently employed in his different reports to distinguish greenish portions in the hydromica series. These are no more slates than are portions of the adjacent hydromicas, which are of identical structure. Nor, indeed, are they true chlorites, having but a low percentage of magnesia. (A recent analysis of some of the greenest of this so-called 'chlorite slate,' made for the writer by Prof. S. P. Sharples, gave only 4.28% of magnesia.)

Hydromica slate, as meaning hydromica schist, is also used several times in the report on Chester county, and the synonymous terms 'talc slate,' 'mica slate,' 'talc-mica slate,' 'talc-mica schist,' 'micaceous talcose slate,' and 'South Valley Hill slates,' are employed more than fifty times in the same report without distinction between slate and schist. Professor Rogers, as is well known, used most frequently the expression 'talc-mica slate.'

That the term 'slate' has been used synonymously with 'schist' in the region of the South Valley Hill, is not only shown by the indiscriminate use of those terms by Rogers, Lesley, and Hall, but is apparent in a remark by Dr. Frazer himself in the Chester-county report, p. 279, where he says:—

"South of the Valley limestone, which only touches the extreme angle of the township, are hydromicas and mica-schists, dipping about south 35°, east —62°. The southern contact of limestone and *slate* occurs in this corner. . . . The hydromica schists and mica-schists to the south, which enclose this, are principally vertical," etc.

Now, as the only slates which occur at this locality are hydromica slates belonging to the hydromica

series of rocks of the South Valley Hill, these must be the slates referred to, even if 'hydromica slates is a contradiction in terms.'

While the undersigned certainly does not intend to be a champion for the term 'slate' instead of 'schist' for these rocks, good reason for the use of that term lies in the slaty character of many of these hydromicas as distinguished from the contorted and schistose character of the micaceous rocks of other regions.

The writer's use of the expression 'hydromica slate' in describing the Edge Hill and Barren Hill rocks (the 'altered primal slates' of Rogers), is thought preferable to the term 'hydromica schist,' since large portions of that formation are slaty rather than schistose. The greater part of the formation is a slaty sandstone or quartz slate, and, where outcropping in Chester county, is so designated by Dr. Frazer. It might naturally be taken for granted that the writer believes, with Dr. Frazer, that the hydromica schists and slates of the South Valley Hill of Chester county are about contemporaneous with this quartz slate or Edge Hill rock.

In order to prevent future misapprehension, it may here be stated, that the writer has been led to the conclusion that the two formations are distinct, and that both Professors Rogers and Frazer have confounded two rock series belonging to different geological horizons, — the one, Cambrian; the other, Silurian. The analogue of the Edge Hill rock is believed to occur in Chester county, on the south side of the hydromicas of the South Valley Hill. The facts leading to this conclusion have been gathered during some extended field-work in Chester county, and will shortly be published. Meanwhile, the remarks upon the primal slates made in the Franklin institute lecture should be understood as referring solely to the Edge Hill rocks proper, and not to the South Valley Hill schists or slates, which are but poorly defined in the vicinity of Philadelphia.

H. CARVILL LEWIS.

The specific distinctness of the American and European brine shrimps.

In Professor Smith's notice of our 'Monograph of phyllopod Crustacea,' he states, that, in the portion relating to the above subject, 'there is certainly confusion,' and quotes two paragraphs relating to the females alone, and finally remarks, "but differences like these in statements of observation betray inexplicable carelessness."

After quoting the two paragraphs relating to the *females alone*, it seems to us a careful critic would have also taken pains to have quoted the longer paragraph relating to the males, which directly follows the first paragraph quoted by our critic. To allow the two paragraphs relating to the females to be so widely separated was an oversight on the part of the author, who, however, thought that he had taken a good deal of pains to show the specific distinctness of the American and European species. Two sets of females from different localities, named by different persons, were examined at different times; and this explains how the two paragraphs became placed too far apart in the author's copy. It would have been better, of course, if the author had added a few words, and dogmatically stated that the two species were undoubtedly distinct. He preferred not to do, or omitted to do, this, but gave in considerable detail, and in as judicial a way as possible, the facts of the case. At first it was 'difficult to find good differential characters' between the females, and those found are but slight ones. The females of any of the species of Artemia, Branchinecta, or Branchipus, do not exhibit good specific characters; but the males do, as the author attempted to show. If the author failed in directness of statement on this subject, or led to any confusion in any one's mind, he sincerely regrets it: on the other hand, he doubts whether there were, in the case, reasons for the charge of 'inexplicable carelessness.'

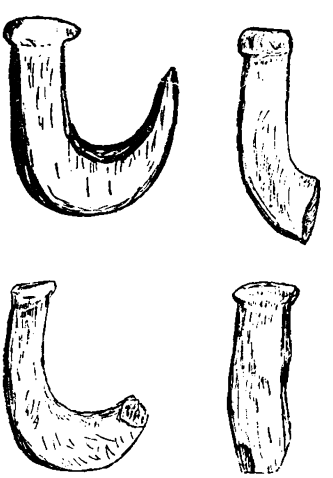
The paragraph which Professor Smith would have done well to have quoted is the following one: —

"Upon comparing a good many males from Great Salt Lake with several, both stained with carmine and unstained, received from Cagliari, Sardinia, through Prof. J. McLeod of Ghent, the European A. salina is seen to be considerably stouter, the head wider, the eye-stalks longer and larger, and the eyes larger. The frontal button-like processes of the first joint of the claspers are nearly twice as large as in the American species, and a little more pointed, while the claspers themselves are larger and stouter. The legs and sixth endites are of about the same form. The most apparent difference is in the caudal appendages, or cercopods, which in A. salina are several times larger than in A. gracilis, being in the Sardinian specimens nearly three times as long and much larger than in our species. In this respect, the genus shows a close affinity to Branchinecta. However, in a lot of A. salina ♀ from Trieste, the cercopods are very much shorter than in the Sardinian females, and only a little longer than in our American specimens. These appendages do not differ in the two sexes."

A. S. PACKARD, Jun.

Bone fish-hooks.

Recently, while digging in a shell-heap near Narragansett Pier, Rhode Island, I found among broken arrow-points, and fragments of bone, pottery, and shells, a nicely worked bone-hook, and also the shanks of three other apparently similar hooks; while in a neighboring shell-heap two more fragments were found.



The perfect hook measures a little more than one inch in length, and a little less than one inch across from the shank to the point, the latter being nearly as long as the former. The shank is flattened and notched at the end, forming a sort of head, somewhat similar to the fish-hooks of the present day. This hook, although much shorter, resembles a hook from Long Island described and figured by Mr. Charles C. Abbott on p. 208 of his work on Primitive industry. Of this he says, "Objects of this character are exceedingly rare, either as found on the surface, or in shell-heaps. While of so simple a form, bone fish-hooks of this pattern do not appear to be common in any locality in eastern North America."

Figures are here given of the perfect hook, and the

fragments of three others which appear to be precisely similar. MARGARETTE W. BROOKS.

Nov. 1, 1883.

Supposed glacial phenomena in Boyd county, Ky.

A part of the work devolving upon us who have recently been tracing the southern boundary of the glaciated area in America, has been to follow up the reports of glacial phenomena south of our line.

Boyd county, Ky., having been referred to by a number of authorities as such a locality, I was naturally led to visit it a short time since; and I found, to my satisfaction, that that region was never directly glaciated.

Boyd county is in north-eastern Kentucky, bordering upon West Virginia, and upon the remarkable bend of the Ohio River where it receives the waters of the Big Sandy. Through the attention of Mr. John Campbell of Ironton, O., and Mr. J. H. Means of Ashland, Ky., I was assisted in making a pretty thorough examination of the region. Upon going back about two miles into Kentucky from the Ohio River, opposite Ironton, we find ourselves in a valley two miles wide, running parallel with the Ohio River, and two hundred and twenty feet above it. This valley extends for many miles, reaching the river towards the west at Greenup, and continuing some miles, at least, above Ashland. It is known as Flat Woods. The level is remarkably uniform; and the hills upon either side of it rise about two hundred feet, with numerous lateral openings towards the Ohio. When upon the farther side, and looking northward, one sees the rocky bluffs of the old channel rising so like those facing the river itself, that he can scarcely resist the illusion that he is in the present valley of the stream. The supposed glacial phenomena consist of numerous water-worn pebbles of quartz and quartzite scattered along the whole range of this old valley. Most of the pebbles are small, and perfectly rounded, though some were a foot or more in diameter; and one observed was about two feet and a half through, and only slightly worn. These pebbles are not found upon the hills back from this channel, on the Kentucky side, nor, according to Mr. Campbell, who is a most competent witness, anywhere in Lawrence county, O., back from the river. Plainly enough, they are the result of water-transportation. Whether they were deposited at the very early period when the Ohio flowed at the level of two hundred and twenty feet higher than now, and regularly occupied this old channel, or whether they were brought into place during the existence of the glacial dam which I have supposed at Cincinnati, I will not venture to say; though the latter theory would seem more in accordance with the facts published by Professor White concerning the old channel followed by the Chesapeake and Ohio railroad, extending from the Kanawha River to the mouth of the Guyandotte in West Virginia. The elevation of the Kanawha-Guyandotte channel is nearly the same as that of the one I am describing, and this seems to be a prolongation of that. At any rate, the pebbles can only be indirectly referred to glacial action.

Now that attention is directed to this class of investigations, it would seem to be important for Professor Lewis to give through your columns, or somewhere else, publicity to his investigations of the facts supposed to indicate glacial action in Pennsylvania farther south than the boundary-line indicated by our investigations two years ago.

G. F. WRIGHT.

Oberlin, Nov. 5, 1883.

Elliptic elements of comet Pons-Brooks.

While the orbit by Professor Boss, published in SCIENCE, No. 34, represents observation so well that there can be no doubt of the identity of the two comets, still it is of interest to know how closely elements derived from observations of the present comet alone agree with those of the Pons comet.

The arc of anomaly already passed over is only about twelve degrees, — a condition very unfavorable to the precise determination of elements, and inadequate to determine a reliable periodic time.

On account of this, in the solution of the equations, Δe was considered as a known quantity, and finally an assumed value substituted for it.

I find the following corrections to Professor Boss's elliptic elements from the normal places given below: —

$$\begin{array}{llrrl} \Delta\pi & = & -194.0'' & - & 78{,}768.\ \Delta e \\ \Delta\Omega & = & +\ 19.5'' & + & 289{,}233.\ \Delta e \\ \Delta i & = & -\ 57.5'' & + & 55{,}256.\ \Delta e \\ \Delta T & = & -\ 0.065235 & - & 108.39\ \Delta e \\ \Delta q & = & +\ 0.000716 & - & 0.04\ \Delta e \end{array}$$

Assuming the eccentricity to be 0.954996, which closely approximates to the true value on the hypothesis of identity, we have for Δe, -0.000274.

The resulting corrections to the preliminary elements are, —

$$\begin{array}{lcl} \Delta\pi & = & -172.4'' \\ \Delta\Omega & = & -\ 59.7 \\ \Delta i & = & -\ 72.6 \\ \Delta T & = & -\ 0.035537 \\ \Delta q & = & +\ 0.000727 \\ \Delta e & = & -\ 0.000274 \end{array}$$

and the corrected elements are, —

$$\begin{array}{lcl} T & = & 1884,\ \text{Jan.},\ 25.66046 \\ \Omega & = & 254^\circ\ 07'\ 48'' \\ \pi & = & 93\ 18\ 50 \\ \omega & = & 199\ 11\ 02 \\ i & = & 74\ 02\ 05 \\ lg\, q & = & 9.889708 \\ e & = & 0.954996 \end{array} \Big\} 1883.0$$

After obtaining the preceding results, the equations were solved for the value of Δe, with the result $\Delta e = -0.000032$; but no use was made of this.

Normal places, 1883.0.

Mean date, Greenwich mean time.	α	δ	No. of observations.
	h. m. s.		
Sept. 8.5 . . .	16 30 38.75	63° 49′ 12.5″	28
" 22.5 . . .	16 25 17.65	60 45 52.3	16
Oct. 6.5 . . .	16 30 28.52	57 42 35.9	8
" 20.5 . . .	16 45 00.31	54 50 37.4	6

These normal places are represented by the corrected elements, as follows: —

	$C - O.$	
	$\Delta\alpha \cos\delta.$	$\Delta\delta.$
I.	$-0.5''$	$+1.3''$
II.	-1.2	-0.1
III.	$+4.4$	$+0.9$
IV.	-0.8	-1.2

The last two places depend entirely upon Albany filar-micrometer observations.

In order to form some idea of the accuracy attained in modern observations of faint comets, the following table of comparisons, with the corrected elements, may be of interest. The comparisons are not very

rigorous, and are liable to accidental errors of one or two seconds.

$C - O$.

Date, Greenwich mean time.	Observatory.	$\Delta\alpha \cos\delta$.	$\Delta\delta$.
Sept. 3.6	Harvard	[+ 21″	— 3″]
" 4.7	Harvard	+ 9	— 6
" 4.7	Harvard	[+ 23	— 3]
" 4.7	Harvard	[+ 22	— 2]
" 5.4	Kiel	— 10	+ 14
" 5.5	Albany	— 3	— 7
" 5.5	Harvard	[+ 12	+ 4]
" 5.5	Wien	— 4	+ 1
" 5.6	Albany	— 3	+ 11
" 5.6	Cincinnati	0	+ 12
" 5.6	Leiden	— 2	+ 10
" 6.4	Königsberg	[+ 12	— 26]
" 6.4	Dun Echt	— 2	+ 3
" 6.5	Harvard	[+ 12	+ 5]
" 6.6	Albany	— 3	+ 2
" 6.6	Albany	— 5	+ 10
" 6.6	Harvard	— 1	— 10
" 6.6	Cincinnati	+ 3	+ 3
" 6.8	Harvard	[+ 22	0]
" 7.3	Wien	+ 5	+ 4
" 7.4	Kiel	— 4	+ 1
" 7.5	Harvard	[+ 17	+ 10]
" 8.4	Leiden	— 3	— 3
" 8.4	Dun Echt	— 4	— 9
" 9.3	Pulkowa	+ 3	0
" 9.4	Kiel	— 2	+ 2
" 9.5	Strasburg	— 1	— 3
" 9.6	Albany	— .1	— 2
" 9.6	Harvard	+ 2	— 15
" 10.4	Pulkowa	+ 4	+ 2
" 10.5	Kiel	— 1	+ 6
" 10.5	Dun Echt	+ 1	+ 1
" 10.5	Strasburg	+ 2	0
" 10.8	Cincinnati	+ 7	+ 5
" 11.5	Kiel	— 9	+ 5
" 11.6	Dun Echt	— 5	+ 5
" 17.3	Pulkowa	+ 6	— 3
" 18.5	Albany	— 1	+ 7
" 19.3	Kiel	0	— 1
" 19.4	Strasburg	— 3	— 4
" 21.4	Strasburg	— 1	— 5
" 21.6	Albany	— 3	+ 1
" 21.6	Albany	0	— 7
" 22.3	Königsberg	— 1	+ 6
" 23.3	Wien	— 5	— 2
" 23.3	Kiel	— 6	— 2
" 25.4	Leiden	— 3	+ 6
" 25.6	Albany	+ 11	— 6
" 25.6	Albany	+ 7	+ 5
" 26.6	Albany	— 1	— 7
" 26.6	Cincinnati	— 9	+ 9
" 26.7	Albany	+ 3	+ 3
Oct. 3.6	Albany	+ 5	— 2
" 4.6	Albany	+ 3	+ 3
" 4.6	Albany	+ 6	0
" 4.6	Albany	+ 3	— 2
" 5.5	Albany	+ 1	+ 4
" 7.6	Albany	+ 6	+ 2
" 7.6	Albany	+ 3	— 2
" 9.5	Albany	+ 8	+ 5
" 16.5	Albany	0	— 9
" 17.5	Albany	+ 2	0
" 18.5	Albany	+ 6	+ 1
" 21.5	Albany	— 5	0
" 24.6	Albany	— 4	+ 5
" 25.5	Albany	— 3	— 5

The observations enclosed in brackets were not used as exhibiting large systematic or accidental errors.

A few observations were made with ring-micrometers, but it is not possible to determine how many. At Albany the ring was used until Sept. 21, afterwards the filar micrometer.

The following table shows the constant difference for each observer when there are three or more observations given, and includes nothing later than Sept. 26:—

Observatory.	No. of observations.	$\Delta\alpha \cos\delta$.	$\Delta\delta$.
Albany, B.	8	— 1″	0″
Albany, E.	4	+ 2	+ 3
Cincinnati	4	0	+ 7
Harvard, Wn.	7	+ 18	+ 2
Kiel	7	— 5	+ 4
Leiden	3	— 3	+ 4
Pulkowa	3	+ 4	0
Strasburg	4	— 1	— 3
Wien	3	— 1	+ 1

These constant errors, though founded on rather slender material, probably represent fairly what is to be expected from modern observations of comets.

Following are the heliocentric co-ordinates:—

$$x = r\,(9.580346)\ \sin\,(153^\circ\ 14'\ 15.1'' + v)$$
$$y = r\,(9.996200)\ \sin\,(\ 82\ \ 04\ \ 40.0 + v)$$
$$z = r\,(9.970401)\ \sin\,(174\ \ 59\ \ 17.4 + v)$$

H. V. EGBERT.

Dudley observatory, Albany, N.Y.,
Nov. 6, 1883.

Rapid geological changes in Alaska.

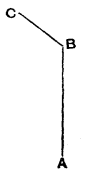
Mr. Dall kindly calls my attention to an error in the note of my remarks, given in SCIENCE of Oct. 19. Hood's Bay is nearly a degree south of the locality of the submerged forest described. Looking at my diary, I find the entry 'Hoona,' which is, I believe, synonymous with 'Bartlett Bay' of some charts. While making my verbal remarks at the academy, I mistook my pencilling of 'Hoona' for 'Hood.' The exact location of the forest is latitude 58° 27′, longitude 135° 40′. I am very much pleased to find from Mr. Dall's letter that my view of the modern changes, drawn from botanical facts chiefly, derives support from some geographical evidence within his reach.

THOMAS MEEHAN.

The mechanism of direction.

I read with interest Professor Newcomb's article on the sense of direction (SCIENCE, Oct. 26). Professor Newcomb says nothing about the behavior of the subjective co-ordinates under a slight change of angle. My experience in this respect I give below, and I have reason to believe the experience to be quite general.

The street A B turns into B C. Walking from A to B, my co-ordinates begin to change when about a hundred yards from B. By the time I get to B, or rather just after B, they have changed by the angle A B C, no matter how large or how small A B C is. The same takes place in going from C to B to A. While close to B on either side, I can by an effort imagine myself under the old co-ordinates; but the new ones are much more natural. In the dark, I think the turn is not seen so far ahead, and the change takes less time. If I go from A to B, with my eyes turned towards A, I have a different experience. I have never tried it by *walking* backwards; but I have observed my sensations while riding on the back platform of a street-car. As the car turns at B towards C, and I am looking towards A, my co-



ordinates begin to change rather suddenly; but there is no sign of a change before B. Shortly after B, I still can conceive myself under the co-ordinates formed on A B, by a mental effort. After about a hundred yards the new co-ordinates have entirely displaced the old.

At the corner of 13th and Spring-Garden streets in Philadelphia I had an experience like that of Professor Newcomb. For a long time I could not approach the place, riding or walking, without my co-ordinates changing by 90°. I cannot account for it. Gradually it wore off, and now no change takes place.

JOSEPH JASTROW.

Johns Hopkins university, Nov. 6.

INTERNATIONAL GEODETIC ASSOCIATION OF EUROPE.

Verhandlungen der vom 11 bis zum 15 September 1882, im Haag vereinigten permanenten commission der europäischen gradmessung. Redigirt von A. HIRSCH und T. VON OPPOLZER zugleich mit dem general bericht für die jahre 1881 und 1882. Berlin, *Reimer*, 1883. 6+155 p., 2 maps. 4°.

THE proceedings of the annual meeting of the committee at The Hague, Sept. 11 to 15, 1882, have just been published. The permanent committee consists of the following members: Lieut.-Gen. Ibañez of Madrid, president; Dr. von Bauernfeind, vice-president; Dr. Hirsch of Neuchâtel, and Dr. von Oppolzer of Vienna, secretaries; Mr. Faye of Paris; and Major-Gen. Baulina of Florence. The delegates, eleven in number, represent most of the countries of Europe. Some invited guests also attended the meeting. The session was opened by the minister of state, Rochusson of Holland, who extended to the members a cordial welcome, which was responded to by President Ibañez.

The last meeting was held at Munich in 1880; but the commission resolved to omit the contemplated meeting for 1881, in order to give its members an opportunity to attend the Geographical congress at Venice: the reports therefore submitted by the several representatives cover the work done, or in active progress, during the two years 1881 and 1882. Secretary Hirsch alludes to the loss sustained by the association since its last conference, in the death of Dr. Carl Bruhns, a member of the commission since 1864; in the death of Gen. de Ricci, one of the veterans of Italian geodesy; of Col. Adan of Belgium, and Professor Stamkart of Holland. The latter had shown that the mean level of the North Sea had not changed during the past hundred and fifty years with respect to the zero of the tide-gauge at Amsterdam. And, last, the association had to mourn the loss of Professor Plantamour of Geneva, whose labors in astronomy and physical geography are so well known, and to whose zeal the recent developments in levels of precision and the progress made in pendulum observations are so largely due.

The Italian commission was increased by Professor Fergola of Naples, by Professor Celoria of Milan, and by Lieut.-Col. de Stefanis of Florence. Austria nominated Capt. von Kalmar and Professor Herr as commissioners; Holland completed its representation by Professor Schols of Delft; and Roumania sent Major Capitancanu. The honorary president and founder of the association, Major-Gen. Dr. Baeyer, who, on account of ill health, was unable to attend, presented a report of the labors of the Geodetic institute of Prussia during 1881–82. He makes mention of the success of the experiments[1] to determine the difference of temperature between the bars of platinum and brass of the Brunner base-apparatus by means of thermo-electricity. The researches for local deflection of the vertical were extended from the Harz to the shores of the Baltic and the North Sea with the result of proving it a region of predominating negative (A.—G.) deflection, varying between 4″ and 7″. A list is presented of seventeen works published by the institute during the interval. Several of these relate to levels of precision; and the pamphlet by Dr. Sadebeck, entitled 'Literature of the practical and theoretical measurement of arcs,' deserves special mention. In a discussion closing the first session, relative to the probable error in the assigned length of the pendulum, it was stated, that, to judge from the accord of the several swings, it might be estimated at about one micron, but that the oscillations of the pendulum support introduced a constant error, seriously influencing the accuracy of the result; the *direct* measure of the motion of the support entering the result being only a fortieth of the correction to pe applied. By this method the accuracy is estimated at .01 mm. The proposition by Cellerier to swing successively on the same stand two pendulums of the same form and construction, but of very unequal weight, promises complete success towards correcting the defect in question; and the experiment is now being carried out. The second session was chiefly occupied with the reading of reports, and with a discussion respecting the value of the prismatic transit instrument. Six of these instruments employed in the Italian survey gave entire satisfaction, especially with regard to perfection of their images. The dis-

[1] Published in *Astronomische nachrichten*, no. 2451.

cussion was continued in the next session with remarks about the greater variability of the error of collimation in the prismatic transit; but its superiority in its low Y's over the common form of the instrument was recognized. In connection with the pendulum of reversion, Hirsch refers to the observations of Mr. C. S. Peirce of the U. S. coast and geodetic survey, at Geneva, Berlin, and Hoboken in America, which prove experimentally the theoretical conclusion of the complete elimination of the resistance of the air by the use of Bessel's pendulum of reversion, — a conclusion indorsed by Ferrero from experiments made in Italy. In the fourth session, Villarceau explains the construction of his new apparatus for the relative measure of the intensity of gravity, and the commission recommends a direct comparison of the new apparatus and of the apparatus of Cellerier at a number of stations. A discussion followed on self-registering tide-gauges and river-gauges; Mr. Diesen stating, that in Holland as many as sixty-four instruments were in operation, or being put to immediate use. Professor Nagel was elected a member of the permanent commission. In the following session the business programme for the seventh general conference of the European association for the measurement of arcs was formulated and adopted: viz., —

1. Reading of the annual report of the permanent commission.

2. Reports of the progress of geodesy by the representatives of the several countries.

3. Reviews of the present state of geodetic operations, subdivided as follows: —

Astronomical longitudes, latitudes, and azimuths (reporter, Backhuyzen); Triangulations (reporter, Ferrero); Base-lines and base-apparatus (reporter, Perrier); Levels of precision (reporter, Hirsch); Tide-gauges (reporter, Ibañez); Gravity apparatus (reporter, von Oppolzer); Refraction (reporter, von Bauernfeind); Geodetic publications (reporter, Baeyer); Arc of the parallel in Europe (reporter, Faye).

The proposition to meet at Rome in October next is adopted, pending the favorable acceptation by the Italian government.

The remaining part of the pamphlet is occupied with reports in detail of the progress made during the years 1881–82 in the countries represented. Their contents may be briefly summarized as follows: —

Baden, Germany. — Levels of precision, and publication of the results of the Rhenish triangulation.

Bavaria, Germany. — Observations of terrestrial refraction, lateral and vertical; spirit-levelling, total development to date 2,578 km.; oscillations of the ground, and pendulum observations at the Bogenhausen observatory.

Denmark. — The fourth volume of the geodetic survey is promised towards the close of 1883.

France. — Connection by new triangulation of the base-lines of Melun and of Perpignan; extension of the Algerian arc of the parallel into Tunis; measures of latitudes and of differences of longitude by telegraph. Volume xii. of the 'Mémorial du dépôt de la guerre' is in press, and a table of logarithms of eight places of decimals is in preparation.

Hesse, Germany. — Levels of precision, mean error per km. equals 2.27 mm., from 32 differences in levels, connected by 14 conditional equations.

Holland. — Connection of lines of spirit-levellings with lines of adjacent countries; total length levelled, 283 km.

Italy. — The reconnaissance for the primary and secondary triangulation completed; geodetic levelling and tidal observations; determination of a latitude, an azimuth, and of several differences of longitude, by telegraph; comparative pendulum observations at Rome.

Austria. — Measure of astronomical latitudes; telegraphic determinations of differences of longitude; pendulum experiments; triangulations and astronomical work in general; occupation of points, and attempts of measures of angles, in the high Alps (among these Ankogl at an elevation of 3,263 m.; station Grossvenediger, of 3,659 m.; and of Grossglockner, of 3,798 m.); extension of triangulations in Bosnia, Herzegovina, and Dalmatia; continuation of levelling operations in Austria proper, and in Hungary; observations of the intensity of gravity in the deep mine of Pribram. The work executed in this country is too extended and diversified to be given here in detail: it is graphically represented in a finely executed map in color-print.

Portugal. — Continuation of the triangulation and of tidal observations.

Prussia. — Revision and completion of principal lines of levels. The following important results are recapitulated: Atlantic higher than the Mediterranean from levels between Swinemunde on the Baltic, and Marseilles, *viâ* Switzerland, 0.664 m.; Swinemunde to the Mediterranean, *viâ* Amsterdam and Ostend, 0.658 m.; and Santander to Alicante, in Spain, 0.662 m. The discussion of the tidal observations at Swinemunde showed no

change in the relation of land and water during fifty-four years, and the mean level of the Baltic results with a probable error of ±6.1 mm. The levellings to Constance and to Amsterdam are published, and the mean level of the North Sea is found 9.3 cm. above that of the Baltic. Computation of polar coordinates between geodetic and astronomical points. Determination of latitudes and azimuths. Maximum local deflection of the vertical reaches 6″.1 in the meridian, and 12″.7 in azimuth.

Roumania. — Astronomical determinations of positions.

Russia. — Connection of the triangulation of Bulgaria with that of Russia; astronomical determination of differences of longitude, connecting Bulgaria with Pulkowa, and Tiflis with the triangulation of the Caucasus; pendulum observations continued in the Caucasus; extension of the levels of precision (double measures) up to date, 4,123 km., and of single lines 618 km.

Saxony, Germany. — Publication of part i. of the third section of the astronomical and geodetic observations, comprising ten stations; recomputation of the base at Grossenhain.

Switzerland. — Additions to the triangulations to connect astronomically determined positions, and two new base-lines at Weinfelden (length 2.5 km.) and at Bellinzona (length 3.2 km.), both measured with the Spanish apparatus of Ibañez; mean error of measure, $\frac{1}{6000000}$ for the Aarberg base of 1880, $\frac{1}{3000000}$ and $\frac{1}{9000000}$ for the other two bases respectively. The coefficient of expansion of the iron bar of this apparatus had increased during twenty years $\frac{1}{13}$ part. After sixteen years of labor, the operations of levels of precision have been brought to a close.

Spain. — Determination of the length of the triangle side, Mulhacen-Tetica (82827.546 m. ±0.115 m.), of the great quadrilateral connecting Spain with Algeria; adjustment of the triangulation connected with the base of Olite; junction of the Balearic Islands with the mainland, and observation of one side, of 240 km. in length (Desierto to Torrellas), during the night, by means of electric light; tidal and levelling operations; determination of the longitude between Madrid and Badajos; gravity measures at Madrid.

Wurtemberg, Germany. — Connection of lines of spirit-levellings with levels of the Black Forest.

Belgium. — Comparison of results of the adjusted triangulation.

Norway. — Results of the difference of longitude of Christiania and Bergen, and of two base-lines with probable errors of $\frac{1}{1570000}$ and $\frac{1}{1500000}$ of their length; adjustment of a base-connection with a primary line involving fifty-three conditional equations.

In conclusion, Yvon Villarceau presents a paper on observations made at Paris with an isochronic regulator in connection with his new method for relative measures of gravity; the apparatus, however, had not yet been brought to the desired perfection. C. A. S.

TRYON'S CONCHOLOGY.

Structural and systematic conchology (etc.). By George W. Tryon, Jun. Vol. ii. Philadelphia, *the author*, 1883. 430 p., 69 pl. 8°.

The second volume of Mr. Tryon's work has appeared with commendable promptness. It contains a discussion of the Cephalopoda, Pteropoda, and the Gastropoda, beginning with the pectinibranchs, as far as and including the nudibranchs. The classification is, of course, the same as that criticised by us in the first volume, and cannot be said to improve on closer acquaintance. Some of the allocations seem particularly inadvisable. For instance: Scissurella, usually regarded as of family rank, is combined without reserve with Pleurotomaria in one family. The Bellerophontidae are retained in full family rank; and yet they are with great probability, as suggested by Meek, only large, symmetrically rolled Emarginulas, which latter are put in a different suborder, with the true Limpets, to which they have no close relation, and divorced from the Haliotidae, which they more nearly resemble.

The order Polyplacophora is defined (p. 103) as having the "shell multivalve, consisting of eight pieces inserted upon the back of the animal, and surrounded by a mantle border;" yet with the Chitonidae are placed, to form this order, a family Neomeniidae, which, to say nothing of other differences, have no shell at all.

The order Pectinibranchiata is defined as having pectiniform branchiae in a cavity above the neck, 'having an external opening upon the side of the neck,' dioecious, and with spiral shells.

The order Scutibranchiata is described as having pectiniform branchiae in a cavity above the neck, *or at the lower edge of the mantle around the foot*, dioecious; shell spiral *or conical*, holostomate.

The portions in italics are intended to cover the Docoglossa, which do not belong with the

Scutibranchs at all, in our opinion. Excluding these, which refer only to the Docoglossa, it will be observed that the only difference (according to the definitions) between the two orders is, that the latter has a holostomate shell. Everybody knows that a large proportion of the pectinibranchs of Tryon are holostomate, that is, have an entire aperture without a canal: for instance, Scalaria, Cyclostoma, Litorina, etc. What, then, becomes of the two orders? As a rule, the definitions are deficient in not giving essential characters, even when the groups defined are perfectly valid, and redundant in giving characters belonging to groups of different rank from the one defined, or of no particular value.

Of small errors we have noted not a few; but it is probable that a book of this kind must be expected to have a certain number, and completeness can hardly be looked for. However, the author has brought together an immense number of genera; and the work, when the index appears, will be very useful to conchologists on this account, though it would have been more so, had each genus been given a date, since, in general, there are no references. The coloration of the plates, also, is better than in the previous volume, and the figures for their kind are fairly good. The work is well bound and on good paper, but suffers from inferior printer's ink, which 'overlays' on nearly every page.

In conclusion we may say, that, for use as a text-book for fresh students, this work would be decidedly inadvisable; but those who have already gained some knowledge of modern classification, and of the anatomy and physiology of mollusks, will find it to a certain extent useful, though by no means to a degree commensurate with the labor which has evidently been spent upon it.

ADAMS'S LECTURE ON EVOLUTION.

Evolution: a summary of evidence. A lecture delivered in Montreal, March, 1883, by ROBERT C. ADAMS. New York, *G. P. Putnam's Sons*, 1883. 44 p. 12°.

MR. ADAMS has attempted to summarize in a single lecture the various kinds of evidence that have been adduced in favor of the evolution of plants and animals, and the earth itself. The author claims to be nothing further than a compiler, and aims to present 'an abstract of many books' in 'plain language.' As he has not limited himself to any particular class of evidence, nor confined his attention to any single object, or group of objects, it is obvious that any attempt to treat in a single lecture the wide range of subjects embraced under evolution must prove a failure. It is simply a jumble of facts, collected, for the most part, from popular books and essays, with a considerable admixture of error and misconception. A little familiarity with the more recent discussions on the subject of the origin of the vertebrates (for example, those of Dohrn and Lankester) would have led our author to very different views concerning 'the connecting links' between vertebrates and invertebrates, and saved him the trouble of rehearsing exploded ideas respecting Amphioxus and the ascidians. Any respectable text-book in systematic zoölogy would have told Mr. Adams that an ascidian is not a mollusk, that Balanoglossus is not regarded as an 'intermediate form' between mollusks and such 'jointed animals' as crustaceans and insects, and that corals are not protozoa.

The author's reference to intermediate forms and 'connecting links' shows that he has not grasped the ideas now generally received concerning the genealogical relationship of animals. One or two passages will illustrate this point. "If in twenty-one days the chick passes through the forms common to sponges, shell-fish, fish, and reptiles, does it not suggest that its race may have developed through these lower races during vast ages? If in forty weeks a single man now develops through forms common to all the lower races of animals, may not the race of man have slowly arisen through all the ranks of life below him, each great division leaving its record in the unfolding germ of the latest individual? . . . Through the sponges we find the radiates connected with the protozoans, or first forms of life, such as corals and sea-animalcules."

Under the head of 'Unity of substance' we are told that "the germs which produce men, dogs, sheep, or any of the highest class of animals, cannot be discovered to differ by any test of microscope or chemistry. . . . Each individual begins life in the lowest form of matter, and develops through forms common to all the species below it. A man has by turns the forms of the germs of plant, protozoan, mollusk, articulate, and vertebrate — fish, reptile, and mammal."

The lecture abounds in such loose and inaccurate statements as the above, and must therefore be pronounced an unsafe guide to 'the uninitiated,' to whom the lecture is especially addressed.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Rings of Saturn. — Mr. William B. Taylor recalls attention to the announcement made by Otto Struve in 1851, that the observations of two hundred years showed the rings of Saturn to be widening, and the inner edge of the inner bright ring to be approaching the body of the planet. Later observations tend in the same direction; and, though there may have been unintentional exaggeration in Struve's numerical results, there seems little reason to question the general fact.

Accepting the only tenable theory of the rings, — that they are composed of discrete particles, each revolving in its own orbit, — we may, by Kepler's law, compute the period of rotation of any part of the ring. Assuming the period of the inner satellite (Mimas) to be 22 h. 37½ m., the computed period of the outer edge of the ring is 14 h. 30 m.; of the dividing-stripe, 11 h. 20 m.; of the inner edge of the bright ring, 7 h. 12 m.; of the inner edge of the dusky ring, 5 h. 45 m.; and of the ring as a whole (supposed solid), about 10 h. 50 m. The period of the planet is 10 h. 14 m.

With the complex perturbations induced by the exterior satellites, it is evident that no particle of the ring can revolve in a circular orbit; and it follows, that, in a space so crowded with particles as to give a continuous light, there must be much interference. Whether the collisions at intercepting orbits result in heat or in disintegration, they necessarily tend to a degradation of motion, and hence to a shortening mean radius-vector and a diminishing period.

It thus appears that Struve's conclusions, based on observation, have a rational theoretic basis. The rings are falling toward the planet, and will eventually be absorbed. Indeed, on the generally received meteoric theory of their constitution, it is impossible to regard their present condition otherwise than as an evanescent phase of a progressive evolution.

Mr. Taylor points out that the relation between the rotation periods of the planet and the ring, and the relation between the rotation periods of Mars and its satellites, not only fail to impeach the nebular hypothesis, as some have supposed, but even fail to be anomalous.

If the planet had a velocity of rotation equal to that of a satellite revolving at its surface, it could not approach the spherical shape. And, the concrete form having once been assumed, the rate of rotation must necessarily and continuously diminish through the influence of solar tides, until eventually the planetary day and year are identical. — (*Phil. soc. Washington; meeting* Oct. 13, 1883.) [355

ENGINEERING.

Emery's U. S. testing-machine, Watertown arsenal, Mass. — This machine is described from general and detailed drawings furnished by the designer. The machine excels in strength, capacity, durability, accuracy, and sensitiveness. The demand is said to have been: 1°. A machine to test to 800,000 pounds, and so delicate that it would test a single horse-hair. 2°. Attachments enabling it to seize and hold uninjured, while applying such loads, all usual sizes and shapes of specimens. 3°. Safety against injury by shocks of recoil. 4°. Accessibility of samples and straining parts, while in operation, for purposes of measurement and inspection. 5°. Small cost of operation.

The machine was tested, when finished, to 1,000,000 pounds, and under smaller loads, ranging down to a single horse-hair, with success; and was accepted by the U.S. board appointed to test iron, steel, and other metals. The loads are applied by a hydraulic press; and the weighing is done through reducing-pressure cushions and water-columns terminating at a point of connection with weigh-beams without knife-edges and having extraordinary sensitiveness. Mr. Emery is constructing smaller machines, and scales and pressure gauges involving the nicer and more remarkable devices introduced in the large machine, at the works of the Yale & Towne company, at Stamford, Conn. Mr. Emery's inventions are expected to aid effectively in securing a more exact knowledge of the properties of the materials of construction, and of their value in structures. — (*Amer. mach.*, July 21.) R. H. T. [356

Engineering of the great statue of Liberty. — Mr. Ch. Talausier describes the details of engineering involved in the design of Bartholdi's statue of 'Liberty enlightening the world.' The plan was conceived by M. Bartholdi in 1871, while *en voyage* for the United States. On the hundredth anniversary of the declaration of independence, France offered the great statue to the United States. It was accepted, is now nearly completed, and preparations for its erection on Bedloe's Island, in New York harbor, are being made. The statue is of copper, carried and strengthened by an inner skeleton of iron, One arm, carrying the torch, was sent to the Centennial exhibition at Philadelphia in 1876, and has since been on exhibition in New York. The sculptor first made a model 2.11 m. high, which was then copied on a fourfold scale; and the statue was constructed from this model in sections by similarly enlarging each section. For each piece, a 'centre,' or mould, was made of wood, on which the copper could be worked and fitted. The sheet-copper epidermis of the statue is composed of 300 pieces, and weighs 80,000 kilograms (178,000 lbs.). The iron frame weighs 120,000 kilograms (264,000 lbs.). When finally erected, the sheets of copper will be riveted together with copper rivets 5 mm. in diameter (0.2 in.), and spaces 25 mm. (1 in.) apart. The iron skeleton is to be secured to the foundation at four points by 12 foundation-bolts 0.15 m. (6 in.) in diameter, and extending 15 m. (49.7 ft.) into the masonry. The variation of form and dimensions, with varying temperature, is provided against by the elasticity of every part; and corrosive action is to be checked by

painting with red lead all points of contact of iron and copper. The height of the statue is 46 m. (150.9 ft.) from base to top of its torch, and 34 m. (111.5 ft.) to the top of the head. The index-finger is 2.45 m. (8.04 ft.) long, the eye is 0.65 m. (2.2 ft.) in diameter, and the nose is 1.12 m. (3.67 ft.) long. A dinner of 26 covers has been given in the trunk of the statue. The total weight will be 200,000 kilograms (440,000 lbs.). The granite pedestal will be 25 m. (82 ft.) high, and the cost of the whole not far from 1,200,000 francs ($240,000 nearly). The maximum pressure of the wind on the surface of the statue is reckoned at 87,000 kilograms (191,400 lbs.). —(*Le génie civil*, Aug. 1.) R. H. T. [357.

METALLURGY.

The basic process at Peine works, Germany — All difficulties at these works are said to have been overcome, and phosphoric pig is being made into Bessemer steel.

Analyses of the steel vary as follows: —

	1	2
Manganese	0.47	0.30
Phosphorus	0.06	0.02
Sulphur	0.06	0.03
Carbon	0.14	0.09

The cinder yields the following analysis: —

Silica	2.45
Ferric oxide	5.74
Ferrous oxide	15.10
Manganous oxide	2.75
Alumina	2.85
Lime	46.82
Magnesia	1.14
Phosphoric acid	22.23
Sulphuric acid	0.38
Sulphur	0.54

The Ilsede pig used in the above works contains 2.5 % to 3.1 % phosphorus. The walls of the converter stand 80 to 95 blows; the bottoms, 16 to 24 blows. — (*Eng. min. journ.*, July 14.) R. H. R. [358

Copper production of the world. — Messrs. Henry Merton & Co. of London have compiled statistics of production of copper in tons, from which the following figures are selected: —

	1879.	1880.	1881.	1882.
Chili	49,318	42,916	37,989	42,909
United States	23,350	25,010	30,882	39,300
Spain and Portugal	12,751	14,559	15,693	15,893
Germany	9,976	11,776	13,718	14,235
Australia	9,500	9,700	10,000	8,950
England	3,462	3,662	3,875	3,875
All other countries	39,299	41,278	45,981	46,451
Totals	147,656	148,901	158,138	171,613

The figures are claimed to have been compiled with great care. —(*Ibid.*, July 14.) R. H. R. [359

AGRICULTURE.

Manuring with potash salts. — In a large number of experiments in which potash salts (sulphate and chloride) were applied in the spring, and within three days of the time of sowing, Farsky found the effect to be a decrease of the crop. It is evident, from the author's statements, that the salts were applied in too large quantity in the immediate neighborhood of the seed. Experiments with the crude Stassfurt salts gave more favorable results in many cases. Potassium chloride gave, in most of the trials, better results than the sulphate, and fall manuring better than spring. The effect in the second year was often better than that in the first. — (*Biedermann's centr.-blatt.*, xii. 459.) H. P. A. [360

Manuring oats. — An extensive series of experiments by Beseler and Märcker gave the following interesting results: —

Manuring with phosphoric acid alone produced no notable increase of the total crop or of the grain. Manuring with nitrogen alone, in the form of nitrate of soda, gave an increase of crop roughly proportional to the amount of nitrogen applied. With a light manuring of nitrogen, addition of phosphoric acid produced a further increase of crop: with a heavy manuring of nitrogen this was not the case.

Manuring with phosphoric acid alone did not increase the percentage of proteine in the grain. Manuring with nitrogen alone increased the proteine, but diminished the fat. Addition of phosphoric acid to the nitrogenous manure restored the fat to its original amount, or even raised it above that point. The quality of the grain was best when the total amount of the crop was greatest. In these experiments the total nitrogen of the crops equalled about fifty-five per cent of the amount applied as manure. — (*Ibid.*, xii. 472.) H. P. A. [361

GEOLOGY.

Synchronism of geological formations. — Professor A. Heilprin called attention to Prof. Huxley's conclusions, that, 1°, formations exhibiting the same faunal facies may belong to two or more very distinct periods of the geological scale as now recognized, and, conversely, formations whose faunal elements are quite distinct may be absolutely contemporaneous; and that, 2°, granting this disparity of age between closely related faunas, all evidence as to the uniformity of physical conditions over the surface of the earth during the same geological period falls to the ground. Prof. Heilprin maintained that it can be readily shown by a logical deduction that the first conclusion is almost certainly erroneous, and that the second derives no confirmation from the supposed facts. If, as is contended, several distinct faunas, or faunas characteristic of distinct geological epochs, may have existed contemporaneously, then evidences of inversion in the order of deposit ought to be common, or, at any rate, they ought to be indicated somewhere; since it can scarcely be conceived that animals everywhere would have observed the same order or direction in their migrations. Why has it so happened that a fauna characteristic of a given period has *invariably* succeeded one which, when the two are in superposition all over the world (as far as we are aware), indicates precedence in creation

or origination, and never one that can be shown to be of later birth? Surely these peculiarities cannot be accounted for on the doctrine of a fortuitous migration. Nor can it be claimed, that, through the interaction of the evolutionary forces, a migrating fauna with an early-life facies will in each case, at the point of its arrest, have assumed the character of the later-day fauna which belongs to that position. Therefore it appears inexplicable that a very great period of time could have intervened between the deposition of the fauna of one great geological epoch at one locality, and that of the same or similar fauna at another locality distantly removed from the first. In other words, the migrations — for such must undoubtedly have been the means of the distant propagation of identical or very closely related life-forms (unless we admit the seemingly untenable hypothesis that equivalent life-forms may have been very largely developed from independent and very dissimilar lines of ancestry) — must have been much more rapidly performed than has generally been admitted. What applies to the broader divisions of the geological scale also applies to the minor. Thus the subordinate groups of a formation are almost as definitely marked off in the same order, the world over, as are the formations themselves. After breaks in formations, the appearance of characteristic fossils is largely the same; whereas, on the theory of synchronism of distinct faunas, such a succession would certainly not be constant. The opinion held by the older geologists was therefore probably correct; namely, that formations characterized by the same or very nearly related faunas in widely separated regions belong, in very moderate limits, to approximately the same actual age, and are to all intents and purposes synchronous or contemporaneous. —(*Acad. nat. sc. Philad.; meeting* Oct. 2, 1883.) [362

METEOROLOGY.

Tornado studies. — A study of the tornado of June 7, 1882, in the valley of Säby, has been made by Fineman. It embraces investigations upon the course of this tornado, and the accompanying atmospheric conditions, which are not different from those pointed out by Finley in the case of tornadoes in the United States, and includes a general investigation of the theory of tornadoes, with references to the work of other authors in this field of inquiry. The author refers to the combination of great humidity, high temperature, and absence of wind, as the special condition of tornado formation, and investigates the characteristic phenomena shown in its progress. He further discusses the relation of tornadoes and thunder-storms, and urges increased study in solar radiation and the gyratory motion of fluids, in order to throw light upon this and other meteorological investigations. — (*Sur la Trombe*, June 7.) W. U. [363

Notes. — The annual re-union of the council of the meteorological bureau of France was held in March. The leading discussions related to observations in agricultural meteorology, the securing of reports of thunder-storms and rainfall statistics, and the transmission of telegraphic messages in the interest of the science (*Ann. soc. met.*, March, 1883). —— A valuable contribution to our knowledge of the surface-temperatures of the Atlantic along the coasts of Portugal, Senegambia, and Brazil, has been made by M. Hautreux from the observations taken on the steamers which traverse this region (*Ann. hydr.*, viii. 1883). —— The *Zeitschrift* for August contains a number of climatological articles, discussing observations made at Stuttgart, Frankfort, Lyons, Puebla, Quadalajara, and in southern Brazil. —— The *Annuaire* for May contains a contribution to the study of the climate of central Africa, by M. Angot, from observations, which are rather fragmentary, made at three missionary stations, mostly in 1881. —— Rev. Clement Ley is preparing a work upon the observation of clouds. The international committee, at its meeting in 1882, appointed a committee, consisting of Messrs. de Brito Capello, Clement Ley, and Hildebrandsson, to draw up a scheme of instructions for the observation of cirrus-clouds. —— Dr. Selah Merrill, U. S. consul at Jerusalem, has submitted to the State department a report upon the climate of Palestine, based upon observations covering a period of twenty-two years. An extract is published in the August Weather review of the signal-office. — W. W. [364

GEOGRAPHY.

(Arctic.)

Arctic notes. — The Austrian Jan Mayen expedition arrived at Vienna, Aug. 22, and were received with public festivities. No illness had occurred during their stay on the island. The observations taken are satisfactory. Rich collections have been made, and numerous photographs taken. —— The latest news from the English party under Capt. Dawson, at Fort Rae in the North-west Territory, is favorable, and observations were going on with regularity. Spectroscopic observations of the aurora borealis have been very satisfactory, though the phenomena have not been particularly brilliant. —— Satisfactory accounts have also been received of the work done by the Swedish expedition to Spitzbergen, which has returned without loss or accident. —— Reliable information has at last been received from the Schieffelin party, on the Yukon, near its junction with the Tananah River. They have returned to San Francisco all well. Gold had been discovered twelve miles up from its mouth, on a small river falling into the Yukon. The bed-rock was slate, and the gold found was in smooth washed particles in loose gravel. Winter setting in prevented further search, and the season was found to be too short for satisfactory results in placer mining. Mr. Schieffelin warns prospectors against coming rashly into the country, unprovided with supplies and tools, as nothing suitable for prospecting work can be had there. —— Later reports from the Arctic Ocean north from Bering Strait give little improvement in the conditions or catch of the whaling-fleet over previous advices. The whalers were anticipating better luck toward the end of the season. —— A button and coin obtained at Cape Prince of Wales, from the natives, about a year ago, have been forwarded to the Navy department in the idea that they might be relics of

Putnam, who was lost on the ice during the Jeannette search. They were said to have come from the body of a drowned white man. The natives of this region are fond of inventing such stories, especially since the search expeditions, as they suppose they will be paid for them. Navy brass buttons have been an article of trade on this coast for many years. The fact that Putnam had no such buttons on his clothing when lost, settles the case in regard to these particular objects. —— Bove discusses in the bulletin of the Italian geographical society the meteorological observations made on board the Vega during her voyage in Siberian seas. His article is a *résumé* of the work of Hildebrandsson, elsewhere published. —— In the Bulletin of the *Paris société de géographie*, A. Bellot summarizes the history of the Jeannette expedition, and the distribution of the international polar stations. His paper is accompanied by a map. — W. H. D. [365

(*Asia.*)

Population of Japan. — The last census (January, 1883) gives a total population of 36,700,118 souls, nearly equally divided between the sexes, the males being about one per cent in excess. Kioto, the imperial city, contains 709,000, and Tokio, the capital, 1,064,000 inhabitants in round numbers. — (*Bull. soc. géogr. Mars.*, June.) W. H. D. [366

Petroleum in the Caucasus. — According to the British vice-consul at Batum, Mr. Peacock, the oil-region of the Caucasus covers some 1,200 square miles. The most productive locality is the Apcheron peninsula, where the wells far exceed those of Pennsylvania. The total production has risen from 500,000 barrels in 1873, to about 4,000,000 barrels in 1881. The export from Baku has increased at the rate of 1,250,000 barrels in two years. According to the daily papers, a pipe-line is projected from the oil-region to Baku; and the American producer must rely on the quality of his product, rather than on its cheapness, for the future of our export trade. — (*Brit. cons. rep.*, 1882.) W. H. D. [367

BOTANY.

Observations on yeast fungi. — The fifth part of Brefeld's '*Botanische untersuchungen*' forms a volume of over two hundred pages, with thirteen quarto plates, and treats of the development of the Ustilagineae. The author considers principally the germination of different species of Ustilago, Thecaphora, Geminella, and Tilletia; and, besides sowing the spores in water, he sowed them in nutritive fluids, and by this means was able to get more luxuriant growths than other students of this order of fungi. The germination of the different species may be classed under two different types. In the one, a short promycelium is given off by the spore, and the sporidia are borne laterally; while, in the second type, a whorl of cells is borne at the tip of the promycelium. By using nutritive fluids instead of water, Brefeld was able not only to obtain luxuriant growths of sporidia, but also to keep them alive for several months, or even a year. He believes that the sporidia are merely conidia, and in his cultures they produced fresh crops of conidia for an indefinite period. He further considers that the so-called conjugation of the secondary cells of species belonging to the second type, as Tilletia, is not a sexual process at all, but merely a fusion such as exists in other orders of fungi. When cultivated in nutritive fluids, the whorls of secondary cells do not conjugate or fuse, but produce conidia directly; while in water, which is not favorable to further growth, a fusion takes place. He calls the conidia 'hefe,' from their resemblance to the forms of Saccharomycetes; the difference being, that in one case, although the yeast-like form can be made to propagate itself in fluids indefinitely, we know that it came originally from some species of Ustilagineae, whereas, in the other case, illustrated by the beer ferment, we cannot tell of what form it was originally the conidia. He refers to other hefe-forms in the Hymenomycetes and Ascomycetes. In *Exoascus aureus* he states that the polysporic condition of the so-called asci is nothing more than a hefe-like growth of a few round spores within the ascus. In short, he believes that all yeast-like forms are merely conidia, and denies the autonomy of the Saccharomycetes; nor does he believe that they are closely related to the Ascomycetes. — W. G. F. [368

Insect fungi. — Hoffmann figures an interesting branched variety of the rare Torrubia cinerea Tul., on an adult Carabus from Germany, under the name of var. brachiata. The typical form occurs on Carabid larvae. — (*Flora*, Aug. 21.) W. T. [369

ZOÖLOGY.

Mollusks.

Landshells of Gibraltar. — Kobelt reports, that the fauna of the Rock of Gibraltar is very peculiar, many characteristic species of the Mediterranean being wanting. The genus Leucochroa, for instance, is represented neither in Gibraltar nor on the opposite coast of Morocco. Certain species of Cyclostoma and Pomatias are equally absent from both shores. Twenty species of landshells, including three undescribed species and two new varieties, were obtained on the Rock in May, 1881; but it is supposed that this is a more or less incomplete exhibit, the season of the year being not the most favorable. The locality is peculiarly interesting on account of its intermediate position between Spain and Morocco. The sea-fauna of the Bay of Gibraltar is also very rich, and contains many rare or peculiar forms. — (*Journ. conch.*, iv. no. 1.) W. H. D. [370

Absorption of the shell in Auriculidae. — Crosse and Fischer illustrate and describe the peculiar absorption of the inner parts of the upper whorls of the shell in this family, and also in the genus Olivella. These animals appear to have the power of dissolving entirely the internal partitions of the shell, from a point some distance inside the aperture to the very apex. The only exception in the family Auriculidae is the genus Pedipes, in which the partitions were found intact. The absorption is not always complete, nor are the same parts invariably

missing. Complete absorption was observed in Melampus, Auricula, Blauneria, Marinula, Tralia, Alexia, Monica, Plecotrema; only partial absorption in Cassidula and Scarabus. The case of Olivella is more remarkable; since the allied groups Oliva, Ancillaria, etc., do not, according to the authors, present this peculiarity at all. — (*Journ. de conchyl.*, xxii. 3.) Tryon, however, observes that in Oliva reticularis he has found the walls absorbed away, so that very little of the substance remained, and considers it probable that all shells with close volutions are in the habit of absorbing them internally. It is certainly the case with many of them. — (*Man. conch. Olivella*, p. 64.) W. H. D. [371

Crustaceans.

Anatomy of the spider-crab, Libinia. — E. A. Andrews gives a very careful description, illustrated with three excellent photolithographic plates, of the anatomy of Libinia emarginata, the common spider-crab of the eastern coast of the United States. The paper, which was originally presented as a graduation thesis for the bachelor's degree in the Sheffield scientific school, describes fully the structure of the body-walls, appendages, and the alimentary, circulatory, nervous, and reproductive systems. The structure throughout agrees very closely with that of Maia squinado of Europe. Mr. Andrews's work will be found a very useful guide for American students, as it is the only description thus far published of the whole anatomy of any American brachyuran. — (*Trans. Conn. acad.*, vi., Aug., 1883.) S. I. S. [372

A new host for Cirolana concharum Harger. — Rev. Samuel Lockwood announced the discovery of this isopod in the interior of the edible crab, Callinectes hastatus Ordway. The crab was an adult female, and the parasites were crowded in the left side of the carapace. Incredible to say, there were twenty-three full-grown specimens, measuring three-fourths of an inch by about a quarter of an inch each. The ovaries and the tissues on the left side were completely honeycombed. How long the animal could have lived, and what its real sufferance of pain was, are questions. But with these predaceous wolves, literally consuming its inwards, it surely would soon succumb. It seemed to Mr. Lockwood that they must, when in the swimming larval state, have entered near the eye-stalks of the crab, which, with a large catch of others, was taken at the close of February in Raritan Bay, New Jersey. From the size of the parasites, it would seem they had been in possession some three months. The determination of the isopods was due to the kindness of Mr. Oscar Harger. The query how so large a number could have entered the same place, and at the same time, he thought was met by the supposition that the crab had found a nest of the larvae, and was feeding on them, when a part of the batch entered the host, as conjectured above. — (*New Jersey st. micr. soc.; meeting* March 19.) [373

Arachnids.

Restoration of limbs in Tarantula. — Rev. Henry C. McCook remarked that a tarantula exhibited to the meeting had been kept in confinement nearly a year, fed during winter on raw beef, and in summer on grasshoppers. In the spring it cast its skin by a laborious process, in the course of which it lost one foot and two entire legs. This summer again, during the latter part of August, the animal moulted. The moult as exhibited is a perfect cast of the large spider, — skin, spines, claws, the most delicate hairs all showing, and their corresponding originals appearing bright and clean. The moulting occurred during Dr. McCook's absence, but was just finished when he returned. When the cast-off skin was removed, it showed, as might be supposed, the dissevered members to be lacking. On looking at the spider itself, however, it was seen that new limbs had appeared, perfect in shape, but somewhat smaller than the corresponding ones on the opposite side of the body. The dissevered foot was also restored. The loss of the opportunity to see the manner in which the legs were restored during moult was greatly regretted, but we have some clew from the careful and interesting studies of Mr. Blackwall. Several spiders whose members had been previously amputated were killed and dissected immediately before moulting. In one of these the leg, which was reproduced, was found to have its tarsal and metatarsal joints folded in the undetached half of the integument of the old tibia. Another like experiment was made with an example of Tegenaria civilis. The reproduced leg was found complete in its organization, although an inch in length, and was curiously folded in the integument of the old coxa, which measured only one-twenty-fourth of an inch in length. Dr. McCook's tarantula had lost both legs close to the coxae; and in the moult the hard skin formed upon the amputated trunks was wholly unbroken, showing that the skin had been cast before the new leg appeared. We risk nothing in inferring, that, as in the case of Blackwall's Tegenaria, the rudimentary legs were folded up within the coxae, and appeared at once after the moulting, rapidly filling out in a manner somewhat analogous to the expansion of the wings in insects after emerging. — (*Acad. nat. sc. Philad.; meeting* Sept. 25.) [374

VERTEBRATES.

Birds.

Anatomy of the Passeres. — Mr. Forbes finds the syrinx, as well as all other points examined, of Orthonyx spinicauda and O. ochreocephala, to be strictly oscinine. The carotid of the first is peculiar in that it accompanies the vagus nerve instead of running in the hypophysial canal. On anatomical grounds, O. ochreocephala is separated from the Australian form as Cletonyx of Reichenbach. Contrary to Prof. Parker, Mr. Forbes finds a perfectly oscinine syrinx in Petrocca. — (*Proc. zoöl. soc. Lond.*, 1882, 544.) J. A. J. [375

Respiratory organs of Apteryx. — Under this title, Prof. Huxley gives a succinct account of the lungs and air-sacs as typically found in birds, and notes that the respiratory organs are separated by an oblique septum from the cardio-abdominal cavity, as in the crocodiles. The lungs of Apteryx are strictly

avian, in no wise mammalian, though poorly developed. Prof. Huxley considers them to show a fundamental resemblance to those of crocodiles. The introduction of so many new terms is to be regretted. — (*Proc. zoöl. soc. Lond.*, 1882, 560.) J. A. J. [376

ANTHROPOLOGY.

Indian courtship. — Mrs. H. S. Baird recites a bit of her own observation respecting Indian courtship half a century ago in Wisconsin. When a youth falls in love, he places himself a little way from the maiden's wigwam, wearing one blue and one red legging. He then plays in a minor strain an air upon the flute, pib-pi-gwan. If he is permitted to proceed, he knows that there are no objections to his addressing the loved one. If the parents have objections to him, he is informed that he is too noisy, etc. In the latter case he discontinues his serenades: in the former the flute-playing gives place to visits, the father saluting, and saying, 'Come in, friend: there is room for you;' upon which all the family give a sort of hitch up, to make room for one more around the fire. The young man seats himself by the door, and next to the daughter; as the eldest son and daughter always sit nearest the door, on each side of it. The lover then produces a few small pine sticks, one of which he lights at the fire, and hands to the maiden. If she takes it, he is accepted: if she does not, but lets him hold it until it goes out, he is rejected. When the time arrives for them to be united, the parents of the young man bring valuable presents, such as furs, while the parents of the bride bring ornamental work. These are distributed among the friends. The bride is dressed by her sister-in-law, and conducted to her place in the wigwam to await alone the coming of her husband. In other cases, when father-right prevails, she goes to his home. A man can have as many wives as may be required to dress his game and carry it home. — (*Wisc. hist. soc.*, ix. 311.) J. W. P. [377

The mounds of Wisconsin. — If one wishes to keep himself informed upon archeology, he must not neglect the volumes of the state historical societies. The Rev. Stephen D. Peet has done a good service, with reference to the emblematical mounds in Wisconsin, by presenting in a condensed form not only the description of the structures, but also the names of the most important works in which references to them may be found. Mr. Peet is well acquainted with the effigy mounds, and therefore adds many original observations, which are in the main extremely cautious. Attention is directed to the difficulty of determining the shape of the mounds, by reason of deformations due to the plough, the tramping of cattle, the wear of the elements, the avarice of relic-hunters, and the encroachments of the modern architect. Again: many of the animals once common have departed from this region, such as the buffalo, moose, elk, antelope, bear, lynx, and wild turkey. If the mounds represented in shape the badges, weapons, and symbols of the natives, they, also, are unfamiliar.

The author ascribes to all these mounds a religious significance, in which opinion he is not warranted by what is known. His reflections upon the cross-symbol, however, are very just. As to the shapes of these structures, we have the mace, double bow, groups of cones, triangular enclosures, besides every variety of animal supposed to have lived in this region. Mr. Peet dismisses the 'elephant mound' with a modest introduction to its sponsor. — (*Wisc. hist. coll.*, ix. 40.) J. W. P. [378

Chinese not homogeneous. — Mr. E. Colborne Baber, secretary to H. M. legation, Peking, makes the following interesting statement: "The population of China is far from being so homogeneous as is generally supposed. I have often heard English people assert their inability to distinguish one Chinaman from another; but it may surprise you to hear that a Chinaman, on first coming into contact with Europeans, makes precisely the same remark of ourselves. At first they have some difficulty in even distinguishing a woman from a man. In spite of a general persistence of type, there is at least as much variation among the natives of the eighteen provinces as there is among the inhabitants of Europe. A thousand years before Christ the Chinese nation occupied a mere fraction of the territory which they now possess. Even then they were not homogeneous in manners or speech, and they were environed by many non-Chinese indigenous peoples. Since then the Chinese have spread, not by ousting or exterminating their neighbors, but by a process of absorption: in other words, they migrated among them, and intermarried with them; and their superior energy and comparative civilization gradually effaced the national characteristics of the surrounding tribes. The same process is going on in Tibet, in Burma, in the Shan country, in Tonquin, and in the Straits Settlements. The Chinese blood has been mingled with such diverse stocks as the Tatar, Turki, Tibetan, Burmese, Mon-annan, Tai, and Polynesian." The discussion of this paper by Sir Rutherford Alcock, Sir Thomas Wade, Col. Yule, and Mr. Colquhoun, is a valuable contribution to Chinese sociology.— (*Proc. geogr. soc. Lond.*, Aug.) J. W. P. [379

NOTES AND NEWS.

THE Maryland oyster commission, which has in view the invention of some plan which should check the depreciation of beds belonging to the state without unduly interfering with trade, met in Baltimore recently. It was suggested that dredging be restricted in various ways, and the available grounds increased by sowing the bottom with dead oyster-shells where none now exist. In 1879 Lieut. Winslow found the average in Tangier Sound to be one oyster to 2.4 square yards. In their recent examination of the oyster area of the state, the commission found that the average of sixty-one beds examined was one living oyster to each 3.7 square yards, showing a rapid and important decrease since 1879. The commission finds, as the result of the examination of forty-six oyster-beds, that there are only 1.35 living oysters to every bushel of dredged shells. While the oysters are

growing scarcer, more labor is required to get them, and the amount of dead material which has to be handled is largely increased.

— The Pons comet, now approaching the sun, may be expected to be visible to the naked eye about the first of December; but it is not likely to attain a brightness comparable with that of the conspicuous comets of the last decade, unless it shall have undergone material change since its last reappearance, in 1812. The intensity of its light will be three times greater on Nov. 21 than it was on Oct. 16; and it will increase until about the middle of January, when it may be anticipated that its light will be about equal to that of a star of the third magnitude.

— The announcement of the publication of the Berlin catalogue of zonal stars will have, according to *Nature*, the effect of postponing the publication of the French catalogue, for which a credit of four hundred thousand francs had been asked from the budget commission.

— Dr. B. A. Gould passed through London early in October, *en route* for South America. The printing of the second volume of the Cordoba zones is nearly completed (in London); and Dr. Gould's attention will soon be turned to the publication of another great work undertaken by him at the Argentine national observatory, viz., the Cordoba general catalogue of stars.

— Ensigns H. G. Dresel and A. A. Ackerman, who were detached from the National museum for duty in connection with the recent Greely relief expedition, in spite of unfavorable circumstances, succeeded in collecting some interesting zoölogical and mineralogical specimens. Among them are some of the so-called meteorites of Ovifax.

— Regarding Flamsteed and Morin, Mr. W. T. Lynn writes to the editor of the *Observatory* (August, 1883): "Probably few anecdotes in the history of astronomy are better known to general readers than that related by Flamsteed, respecting the foundation of the Royal observatory being hastened, if not occasioned, by the application of the Sieur de St. Pierre to Charles II. (through the Duchess of Portsmouth) for a reward for discovering a method of finding the longitude at sea, and Flamsteed's own decision on its impracticability until the motions of the moon and the places of the fixed stars had been determined with much greater accuracy than was then possible. But it is not easy to understand the exact meaning of one of Flamsteed's expressions to St. Pierre. He says that he told him, after first proving to him how incompetent a calculator he was, and pointing out, that, independently of this, his method was inapplicable in practice, to go to his own countryman Morin, who would instruct him in a better method than his own, and not to return to the king of England until he had done so. Of course, the general force of this recommendation was, in vulgar English, to bid him go to Jericho. But surely Flamsteed could hardly have been ignorant (though he does not refer to it) that Morin had, in 1634 (forty-one years before the application of St. Pierre to Charles II.), submitted a plan similar in principle to Cardinal Richelieu, and that a committee appointed by the latter came to the same decision as Flamsteed concerning St. Pierre's proposal; that such a method was of no practical use in the existing state of astronomical knowledge. To me, it seems exceedingly likely that St. Pierre was aware of what had taken place with regard to Morin; that, in fact, he had stolen the principle from the latter (who, although he deserves all the contempt that Mädler pours upon him for prostituting astronomy to the purposes of that mass of imposture and delusion which has robbed our science of its more appropriate name of astrology, was a good mathematician for those times), and interpreted Flamsteed's last remark into the imputation that he was in point of fact found out. Flamsteed says that he heard no more of him afterwards; but he certainly did *not* go to Morin, for the best of all reasons, — Morin having died more than eighteen years before, on the 6th of November, 1656."

— In a paper on the germ-theory of disease from a natural history point of view, before the British association, Dr. Carpenter stated that many of the existing genera and species of animals and plants were altogether uncertain; that as fresh knowledge was gained, so it was found necessary to modify our accepted views — this especially holds good with genera which have great power of adapting themselves to various circumstances, and which consequently produce numerous variations. This power of modification, the author stated, was much more marked in the lower than in the higher forms of either kingdom, and was especially found in bacteria. The author then cited the case of the germ producing small-pox, in which he stated the germ had undergone such a modification, that whereas two centuries ago the disease was very severe, and known as 'black-pox,' it now existed only as a mild disease. During the last siege of Paris, however, the conditions were such that the germ reverted to its original form, and produced the same severe disease as two centuries ago. Many facts were brought forward to confirm this view.

— In a paper by Professor Hull before the British association, upon the geological age of the North Atlantic Ocean, the author made use of three leading formations as factors in his inquiry; viz., the archean (or Laurentian), the Silurian (chiefly the lower Silurian), and the carboniferous. He considers that throughout the archean (or Laurentian), the lower Silurian, and the carboniferous epochs, the regions of North America, on the one hand, and of the British Isles and western Europe, were submerged, while a large part of the North Atlantic area existed as dry land, from the waste of which these great formations had been built up; and he urged, that, if such were the case, the doctrine of the permanency of oceans and continents, as tested by the case of the North Atlantic, falls to the ground.

— The meteorological observatory established upon the top of Ben Nevis by the Scottish meteorological society was formally opened on Oct. 17 with interesting ceremonies. A party of ninety, including many

ladies, climbed the mountain, in spite of unfavorable weather; and after their return to the base, where a second meteorological station is established, a dinner, with congratulatory speeches, was given. The funds for the establishment of these observatories, £5,000, have been raised by popular subscriptions, the subscribers numbering about two thousand.

— At the meeting of the German society of natural science at Halle, on Oct. 3, a paper was read by Dr. Assman of Magdeburg, on the advisability of establishing a meteorological station on the Brocken Mountain. 'What will become of the spectre?'

— Drs. Schuchardt and Krause, of the Volkmann clinical hospital at Halle, consider that they have placed the connection between scrofula and tuberculosis beyond a doubt. Following up Koch's line of research, they have discovered the peculiar bacilli of tuberculosis to be present in several distinct forms of scrofula.

— Joseph Antoine Ferdinand Plateau, professor of physics at the University of Ghent, died at that place, Sept. 15, at the age of eighty-two years.

— The U. S. hydrographic office has published a 'List of geographical positions for the use of navigators and others,' compiled by Lieut.-Commander F. M. Green. The list is divided into seventeen sections, according to the geographical position of the places, and is confined to points on the shore or on navigable rivers.

— Dr. J. Lawrence Smith died at Louisville, Ky., on Oct. 12, in his sixty-fifth year. He was born near Charleston, S.C., and was educated at the University of Virginia and the Charleston medical college. He afterwards spent some time abroad. His first paper was published while he was in Paris. A large part of his work was in meteorology, his collection of meteorites being especially famous.

— Among the exhibits at the New-Mexico territorial fair, held at Albuquerque, Oct. 1 to 5, was a collection of antiquities from the old pueblo ruins of Arizona, by Mr. Thomas V. Keam. This gentleman has long been engaged in trade in that region, is well known to the Indians and to our national surveying-parties, and has rendered very efficient service, both as an adviser and mediator, in our negotiations with the Navajos. His exhibit was highly spoken of by the Albuquerque press.

— Dr. D. G. Brinton of Philadelphia, who was one of the vice-presidents of the congress of Americanists held in Copenhagen, and the only delegate from the United States, makes a brief report of the proceedings. In 1875 the first meeting was held at Nancy; that of 1877, at Brussels; of 1879, at Luxembourg; of 1881, at Madrid. The meeting of this year was opened in the magnificent hall of the university, in the presence of the king, the royal family, the Princess of Wales, and other dignitaries. Professor Worsall presided, and delivered the address of welcome. The discussions and papers related to paleolithic man in America, Scandinavian discoveries, the history of Columbus, native American literature, ceramics, trephiny, etc. Dr. Brinton reports that the communications were very generally of a high order, though there was enough of Prince Madoc and the pilgrimage of St. Thomas to remind the members of the humble origin of archeology.

— Messrs. Kegan Paul, Trench, & Co., of London, announce Mr. Everard im Thurm's 'Among the Indians of British Guiana,' sketches, chiefly anthropologic, from the interior.

— M. Berthelot has published the results of his researches into the nature of explosives, under the title of 'Sur la force des matières explosives d'après la thermochimie.' One portion of the book appeared as an article in the *Nouvelle revue.*

In presenting his work to the Paris académie des sciences, M. Berthelot explained that he was led to those researches by the events of 1870. The first book is on his theory of the phenomena of explosion, and especially the explosive wave, which he considers throws a new light on the subject. The second book is on the composition of explosives, and the third on their comparative power. The last is very comprehensive, and he gives numerous tables.

— Mr. William J. Fisher, U. S. signal-observer at Kadiak, has found time, in the prosecution of his duties, to collect for the National museum ethnological specimens from the following Alaskan tribes: Ugashagmint, of Ugashag River, Bristol Bay; Tanichnagmiute, of Lesnoi Island, near Kodiak Island; Nanuachpachmiute, of Aliaska peninsula, near Iliamna Bay; Keiichwichmiut, at Katmai settlement, Aliaska peninsula; Kiatichmynt, near Maltshatna River, Aliaska peninsula; Tshu-attshigmjnt, around Nuchek, Hinchinbrook Island, Prince William Sound.

The editor of the Smithsonian proceedings holds up this invoice of Mr. Fisher as an example to be followed by all collectors. The excellent features are the native names of the articles, the explanation of their functions, and the location of the tribe from which each comes. There is a very grave objection, however, to the spelling of the names and the identification of the tribes. Mr. Dall and others have located many little bands of Eskimo all along the Alaskan coast. Are these the same, or different ones? If the same, why another mode of spelling; and, what is worse, why is 'mut' spelled '*mint*,' '*miute*;' 'miut,' '*mynt*;' 'mjnt,' '*mjut*,' '*mjute*,' '*mjitt*,' '*mjvnt*,' *mjunt*,' and '*mut*'? Strenuous efforts are making to bring order out of chaos in the matter of tribes, but nothing will be accomplished if confusion is constantly introduced by observers.

— Prof. T. G. Bonney read a paper before the Geological society of London on Nov. 7, on the geology of the South Devon coast from Tor Cross to Hope Cove.

— The relation of the state to the medical profession was the prevailing topic in the recent inaugural addresses before the schools of the several hospitals of London. Until 1858 the English people had virtually no protection against unqualified practitioners. In that year the act was passed establishing the present system of medical licensing.

A royal commission was appointed in May, 1881, to inquire into the existing provision, and to recommend such additional action as might seem advisable. The

proposals of the commission were embodied in a bill which passed the House of Lords during the last session, but was lost in the House of Commons through the 'obstructive tactics of interested parties.' It is believed that the bill which will be presented during the next session will meet with better success. As pointed out by Professor Huxley in his address at the London hospital, 'three grave defects remain to be remedied:' viz., the low standard of examination allowed by some of the licensing bodies; the granting of licenses which do not involve proof of the holder's acquaintance with all three of the great branches of medical practice (namely, medicine, surgery, and midwifery); and the present state of the law, which does not permit the medical council to enforce equality of minimum examination, and the threefold qualification, before admitting a medical practitioner to the register. All of these points are included in the proposed bill.

It is further urged by those interested in the improvement of the profession, that liberal education should be a more general characteristic of its members, and that the student should bring to his medical course a more thorough preparation in physics, chemistry, and biology. Both of these ends will be furthered by the provision recently made in the two great universities for the sciences specified.

Socially the medical profession does not compare favorably with the other professions in England. The fact is curiously illustrated by an extract from a recent book quoted by Mr. W. H. Bennet in his address at St. George's hospital. "This choice of a profession," says the author, "is not an easy matter, when, as a rule, the church, the army, the bar, and the diplomatic service are almost the only professions open to a young fellow." Evidently, as Mr. Bennet observes, "the thought of medicine had never for an instant entered the writer's mind."

— Mr. Henry Brooks has prepared a useful series of specimens of the wood of several of the important timber-trees of the eastern states, for the use of teachers and students of natural history.

Each species is represented by three thin transparent sections of wood framed together, and cut in the direction of the layers of annual growth, at right angles with the grain, so as to show a cross-section of the trunk. The specimens mounted between thin sheets of mica permit a satisfactory examination of the position and size of the different ducts, cells, medullary rays, etc., besides showing admirably the color and general character of different woods. Architects and builders, therefore, as well as teachers, will find Mr. Brooks's contribution to a knowledge of our trees of considerable practical value. Complete sets, representing seventeen species, or single sheets, can be obtained by addressing Mr. Henry Brooks, 35 Bedford Street, Boston.

RECENT BOOKS AND PAMPHLETS.

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